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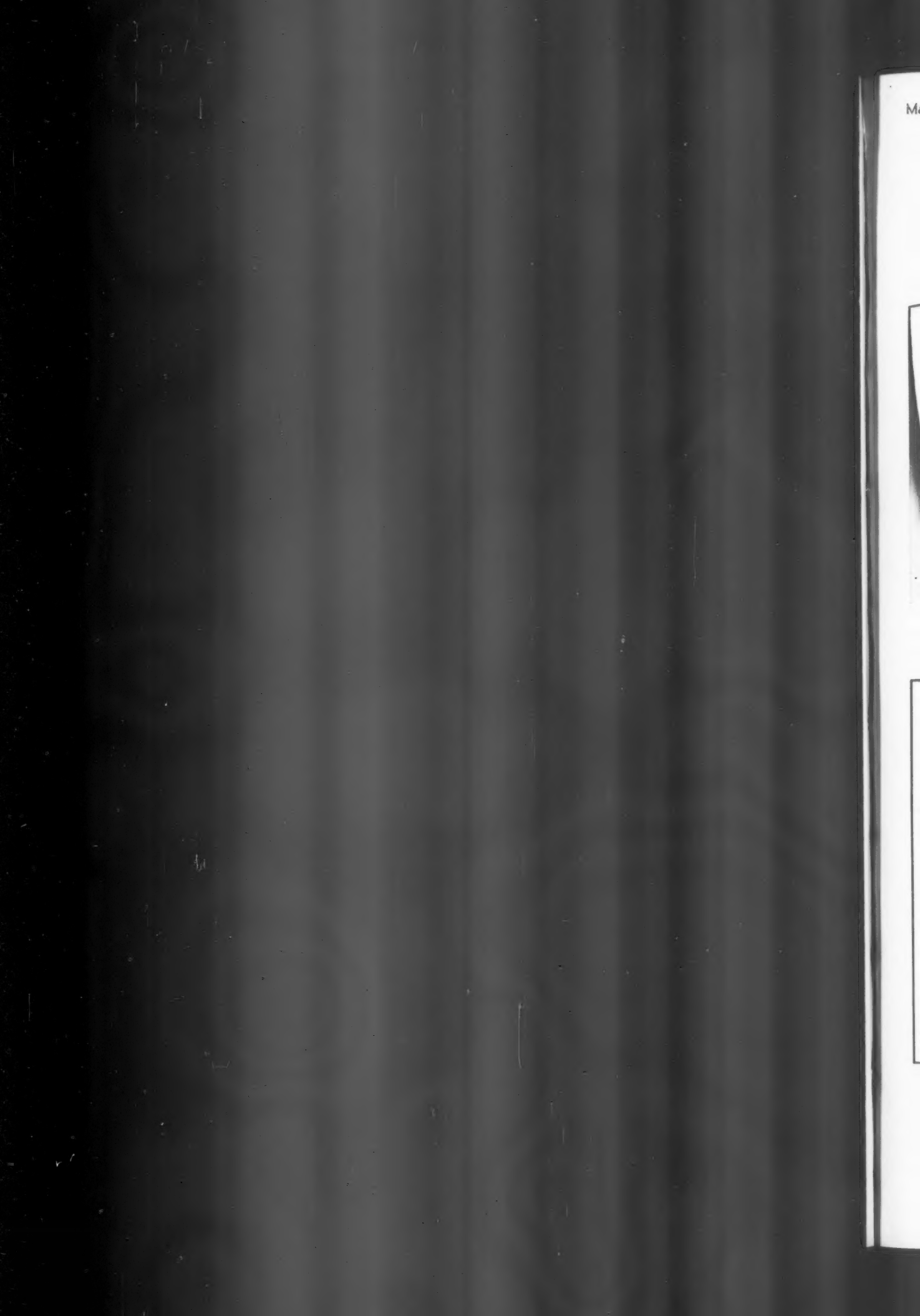

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Has a capacity enrollment of 300 commercial aviation students, 216 U. S. Army Air Corps flying cadets and 48 enlisted mechanics.

Has its own airport with a school plant of 25 buildings devoted to school purposes entirely, also two fields of 568 acres and 96 acres for military flight training.

Has a faculty of 82, each especially qualified for his particular field of instruction.

IF YOU desire to climb to positions of trust and responsibility in commercial aviation, you must *prepare yourself* for *that* goal. For it's your individual preparedness — your preparation training — that largely determines the extent of your success in later life.

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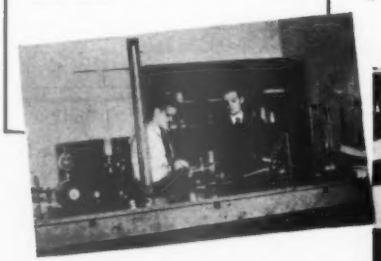

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DON'T take too literally recent talk about American aircraft being so inferior as to be good only for behind-the-lines training purposes. More than anything else, such talk is "for benefit of the press" and for gullible senators and congressmen on whom new appropriations for war materials depend.

Warplanes designed and built in this country are the finest *aircraft* in the world. The controversy raging over them concerns not the planes themselves, but their military equipment. Admittedly, American planes always have been poorly armed; FLYING AND POPULAR AVIATION has called attention to that fact many times, even before the present war began. Britain's Royal Air Force deserves far more credit than it is getting for visualizing the need for eight machine guns on its fighters and power-driven gun turrets on its bombers. But neither the French nor Germans—nor the United States—heeded the British until the R.A.F. virtually beat off the Germans single-handed with that tremendous firepower. Rest assured that new American fighters and bombers are taking advantage of that lesson.

On the other hand, neither the British, French, Nazis—or the U.S.—did anything about armor-plate until actual warfare proved the need for it. With the exception of the Germans, all the aforementioned did nothing about rubber, bullet-sealing gasoline tanks until actual combat cost the Allies hundreds of planes due to gasoline fire. You can be sure the U.S. Army and Navy are getting all these vital features on new aircraft.

Other than the above, American military aircraft are superior to anything flying—anywhere. The newest types now being built for the British and ourselves are armed to the wingtips, armored and have rubber tanks. They will outperform and outfight anything in the air, newspaper columnists and authorities-on-any-subject to the contrary. High-speed production is our big goal now and it is just beginning to roll.

* * *

OUR authors prove an interesting lot from time to time. We'd like to tell you more about them but they're usually pretty close-mouthed and elusive about themselves. Like E. Jay Doherty, for instance. We discovered, via the grapevine, that he gave the British a pint of his blood the other day. Not long before that Ed Churchill quit his job at Paramount Studios and went to work for himself (but not before he'd been talked into writing some sort of script for a Z-picture or something). Meanwhile, we asked William Hurd Barrett for a picture of himself the other day and the return mail

(*Continued on page* 87)

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AND POPULAR AVIATION

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FUNNYBONER DEPARTMENT

Here's a boner I pulled while learning to fly:

I'd had about 2 or 3 hours' dual instruction and was practicing landings with my instructor. I'd completed several pretty good ones and was approaching the runway for another, when the instructor took over the controls.

I thought he intended to keep the controls—and he thought I'd take them right back again. The result was a very bumpy, but successful landing, with nobody at the controls at all!

Winton Smith, Mamaroneck, N. Y.

DON'T TRY THIS ONE IN YOUR BATH TUB!

The hot water tap on a bathtub will fill it in 4 minutes. The cold water faucet

will fill it in 6 minutes. And the drain in the bottom of the tub will empty it in 8 minutes.

With the drain open and both cold and hot water taps on, how long will it take to fill the tub?

YOU'D BE SURPRISED HOW YOU CAN CLEAN UP

If you remember your high school chemistry, you'll recall that one of the first things you were taught was how to use a filter paper.

Probably one of your first experiments was when you took a cloudy, muddy solution and filtered it through a rough filter paper. You found that the solution came through crystal clear, and that the filter paper was stained dark by the residue.

But then, even though your filtrate was crystal clear, you again filtered it, this time through a finer paper. And this time, though the appearance of the solution was just as clear as before, you found to your surprise, that a fine residue had been left behind on the filter paper. You'd made your solution even purer than you thought possible.

You might remember this experiment the next time you're buying oil for your plane. For though many oils look exactly alike, you'd be surprised how much extra impurity you can sometimes get out of them.

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THIS MONTH'S WHOPPER (4 Stars)

Dear Major:

I had an old Jenny once, and for the last few years she's been setting out in my barn. Sorta hated to junk her because we'd had some good times together, Jenny and me.

I was thinking about that the other day—about getting old, I mean—when I spied a story about G.A.G. Well, it looked like this was just the medicine my Jenny needed. So I hauled her out of the barn and filled her up with G.A.G. And then the trouble began.

Say, I didn't hardly have time to get out of the way before little Jenny perked right up and the next thing I know she's circling over the barn and heading off towards the city.

All day long I waited pacing up and down the barn floor, and it was long about sundown when I heard a funny kind of sputtering and there comes Jenny.

Gosh, Major, that ship looked like it had met a couple of hurricanes with a tornado in the middle and when I got her back into the barn and kind of got over being so scared I says to her:

"Jenny, I allus said you was a well-behaved little ship. And you was. Now, where've you been all day?" And Jenny looked at me kind of reproachful like and she says: "Say, Pop, who fed me that G.A.G. anyway?"

"Well," I says, "that don't answer my question. All by yourself you took off and all by yourself you spent all day in the city and all by yourself you come back again. Now what's the story?"

Well, this is Jenny's story:—"Pop, I met an Army Bomber—the handsomest Army Bomber! His approach was perfect. He wiggled his ailerons rather flirtatiously and I wiggled mine back. If it hadn't been for that G.A.G. I'd have been more of a lady!

"We glided along together—even had a couple of wing-overs. Then—then—well he settled down on a soft cushion of air and flipped his flippers invitingly. Pop, can you imagine how I felt? A dashing Army Bomber flipping his flippers at me, an old Jenny! And honestly, Pop, I'd reached the burble point so to speak. I felt like making a power dive for him, but I restrained myself and instead I just settled down too.

"Talk about speed, Pop! They must use G.A.G. in the army too. I'm afraid I completely forgot my excellent training, because after a bit of stalling around I—well—I'm afraid I skidded a little.

"And I don't care if I *am* a bit the worse for wear. Although my wings are a trifle tarnished and I can't hold my nose as high as before; although my struts and spars aren't what they once were; although my landing gear has collapsed and my shock absorbers were shocked off; although my motor is dead and my prop won't go 'round; I still say: More power to G.A.G.!" **D. D.**

P. S. G.A.G. don't *need* no more power!

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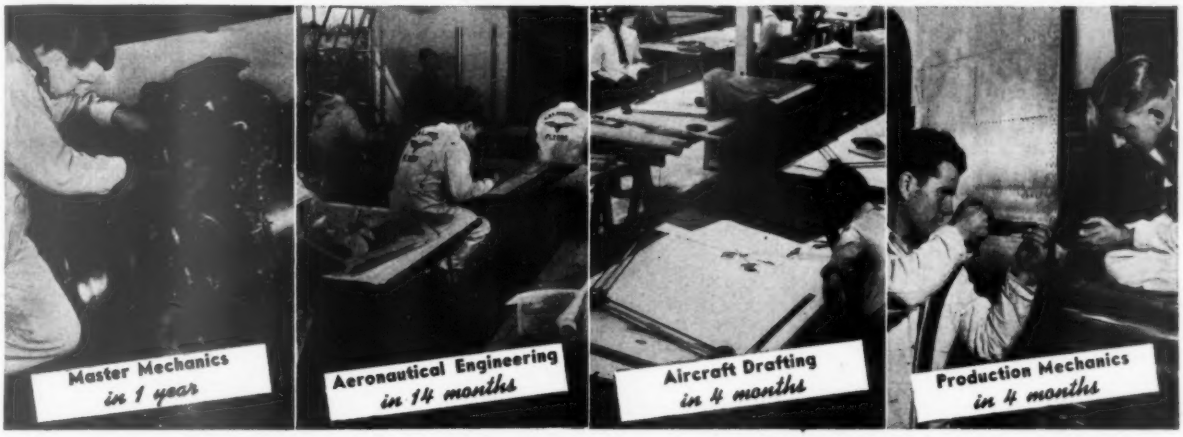

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"I am a California Flyers Graduate." It means something to say that. It means that aviation wants you to the extent that over 96% of all California Flyers graduates are employed in the industry and that it is impossible to supply the demand for our graduates. It is a passport into aviation. Secondly, it means that you are a man marked to succeed like the California Flyers graduates before you. And that is what *really* counts.

Why does a California Flyers man stand so high? It is obvious once you have heard the complete story of this famous school. Its founders believe that aviation should be taught in a school where the student remained an individual—learning aviation as it pertains to his individual ambitions and qualifications, and by so doing preparing *him* for the responsibilities of leadership. This way the graduate is prepared to meet today's aviation problems and to contribute to tomorrow's aviation advancement. This is the way today's leaders learned. Only this way can a training program be built for the industry, on industry's specifications. They believe too, that the entire field of aeronautics:—engineering, mechanics and piloting are all closely interwoven and that a student should train in a school that teaches all of these important divisions. Above all, they believe that aviation should be taught in an environment of aviation activity, taught where the greatest aviation developments originate, taught where there is the greatest number of men actively engaged in aviation. This is why California Flyers is located in the heart of the world's aviation capital on the world's busiest testing field.

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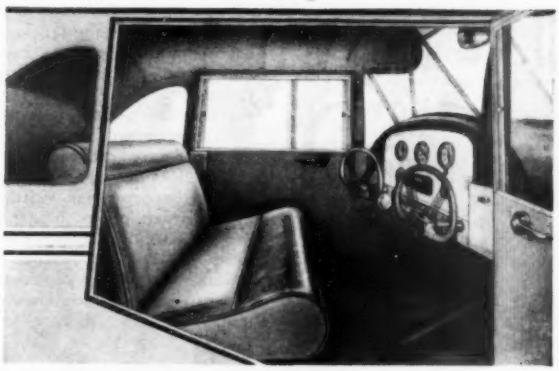

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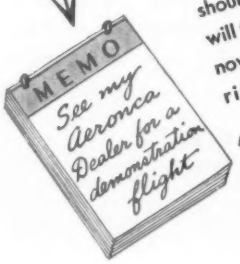

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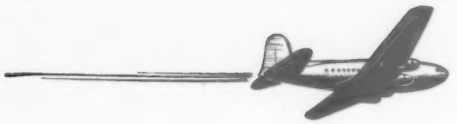

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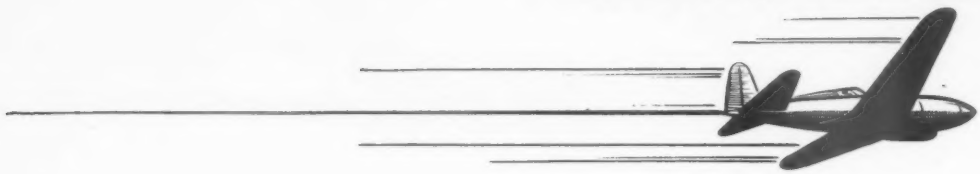

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An Analysis of CAPTURED NAZI WARPLANES

by DE WITT WENDELL

The Heinkel He-111K below, shot down by the R.A.F. was repaired and test flown (above). The He-111K is an easy target.

ACME

The Messerschmitt Me-110 is being used both as a fighter and light bomber by the Nazis.

British aeronautical engineers have released several highly interesting reports on German warplanes shot down by the R. A. F. This article is based on these.

THE most interesting and definite information concerning German military airplanes has come—as might be expected—from England. It has been derived from careful inspections made by British engineers who had the opportunity to survey in leisure and detail the remains of some 3,000 *Luftwaffe* airplanes that have been shot down on English soil.

Most of these were pretty badly damaged. Some, however, got down in excellent general condition. The result has been that virtually every type that has been used against England has come to be well known to the British. At least one of each type has been inspected, patched where patches were needed and flown again by British pilots so that full details of maneuverability, vulnerability, speeds, etc., became available to British fighter pilots.

Most of this information also has been given out for public consumption in England and herewith we present a summary of points disclosed in these inspections of four standard types of German airplanes: the Messerschmitt Me-109 and Me-110, the Junkers Ju-88K and the Heinkel He-111K.

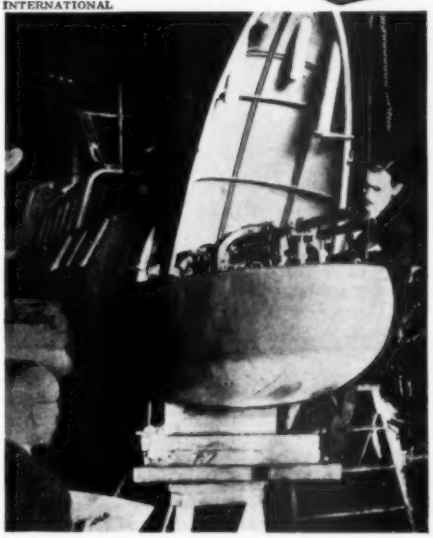
Before narrowing the field to one ship it should be remarked that these German craft are *not* inferior creations. General workmanship is of the highest sort. There is no indication of the use of *ersatz* material—except where such *ersatz* materials perform their work better than natural materials. Stories about wooden wheels on German ships, shortage of instruments, shortage of rubber, shortage of gasoline, all are branded false by the evidence of the German airplanes themselves.

The British report that the German planes have radio equipment that is described as "bewildering in its profusion and complexity." The best quality of rubber (a material in which many said Germany was exceptionally short) is found in an equal profusion. The British add that there is more rubber in German airplanes than in British machines. Tires are excellent, most of them made by German Dunlop or Continental factories.

Fuel and oil found in the aircraft indicate no shortages in these vital essentials. Most of the German planes have the signs of 87 octane fuel stamped on their tanks. But invariably analysis of the fluid in the tank shows it to be of 90 to 92 octane—better than prescribed. Oil in German engines is used slightly longer than in British ships—but airline practice in the United States indicates that oil, unless fouled by bits of carbon or metal scrapings, is improved by use.

Maintenance practices as shown by the German machines are ahead of either British or American at this time. Each particular system — electrical, exhaust, hydraulic, fuel, lubricants, etc.—has its own color on all pipes, fillers, levers and

INTERNATIONAL



The nose compartment of the Me-110 covers four machine guns. Two cannon are below.

controls appropriate to that service. For instance—all oil pipes are painted brown as are oil radiator connections, shutter controls in cockpits, etc.

Here is the complete list: fuel, yellow; oil, brown; hydraulics, brown with red ring; glycol and water (motor coolant), green; oxygen, blue with two white bands; compressed air gun gear, blue with one red band; undercarriage gear, blue with two red bands.

All overflow pipes or outlet pipes are painted blue with a band of the color of system they serve. All points of connection where couplings can be loosened are painted on each side of the coupling with small red crosses. The beauty of the system is that it applies to all military craft, from evidence available. The fighters

INTERNATIONAL

Bullet-sealing 280-gallon tank from Ju-88K is constructed of leather, rubber and fiber.

BRITISH COMBINE

Shot down to a belly landing, this Me-109 was salvaged by British for tests. Note No. 13 on fuselage.

and bombers had exactly the same markings for similar systems.

Now for specific types. Let us begin with the Messerschmitt Me-109. This is, as the world knows, a single-seater, single-engined fighter. The ship is really tiny with a wing span of 34 feet, length of 30 feet, but a weight of 5,500 pounds. The Me-109 has been found with but one type of engine: the 1,150 h.p. Daimler Benz DB-601 which is a V-12 inverted liquid-cooled motor with electric ignition.

Tests have shown that this airplane has a speed of 354 m.p.h. at 16,000 feet. It has a range of 450 miles at full speed—or about an hour and 15 minutes wide open. At less than full throttle this duration can be almost tripled.

Me-109s have been found with varying armament: either four machine guns, or two machine guns and two 20 mm. cannon. The latest types have two .312 caliber machine guns (this is the standard German infantry rifle caliber weapon) in the fuselage, slowed down by interrupter gear to fire between the three blades of the propeller. In the wings, firing outside the propeller arc, are the two cannon.

The airplanes have Germany's standardized VDM electrically controllable propeller—one of the world's best and simplest types, incidentally. This prop has a hollow hub to allow the fitting of a cannon on the engine. But not a single German airplane thus far inspected has had such cannon firing through the propeller. Instead, the propeller hole is used to lead cooling air to electric generators at the back of the engine.

The latest Me-109s have a reflector sight (newest and most accurate gun sights to be developed) made by Carl Zeiss of Jena. The windshield is plate glass and not bullet-proof [*bullet-proof windshields recently have been reported —Ed.*]. The curved portions of the screen and the covering over the roof and sides of the cockpit is 3/8-inch Plexiglas. The hood is hinged to raise to the right for entrance to the cockpit. Sliding windows in the screen allow ventilation and visibility. The whole screen assembly flies off so a pilot can bail out if a spring latch is pulled.

There is only one fuel tank—immediately behind the pilot in probably the most vulnerable position in a fighter aircraft. None of the Me-109s inspected in England have had the self-sealing type of tank and there have been many of these fighters shot down in flames because of the tank arrangement. Its position, well behind the center of gravity, necessitates constant changes in trimming of the airplane in flight as fuel is consumed.

Flush riveting is used throughout the plane, as it was in all German craft inspected here. The wings are held on the fuselage by only three bolts, but apparently are amply strong. Trim is attained by a moveable horizontal stabilizer (an anomoly in today's more usual tabbed aircraft). Slotted flaps extend from the ailerons to the fuselage, their setting being indicated by lines painted on the upper surface marked with 0, 10, 20, 30 and 40 degrees. Handley Page wing tip slots extend some eight feet from the wing tip to the mounting for the wing cannon, giving slow speed aileron control.

The cockpit is comparatively barren. The pilot's seat is adjusted by a lever on the left hand side. The control column is short, with a rubber grip and gun controls at the tip. Rudder pedals fit the whole foot with a flanged edge to prevent slipping. Brakes are operated by toe pressure. Also on the left is the trimming wheel and throttle controls. At right are oxygen bottles and lines, a hang gear for the main wheel retraction—this is manual with a simple, fool-proof worm or screw linkage.

Instruments are adequate but not plentiful. They include two sensitive altimeters, a turn and bank indicator, a magnetic bowl-type compass, an airspeed indicator that reads up to 750 kilometers per hour (446 m.p.h.), a boost or manifold pressure gauge, fuel pressure and oil pressure indicators, motor coolant temperature gauge, a fuel tank capacity gauge and oil temperature gauge. The electric system included radio receiver and transmitter switches, formation lights, signal lights, instrument dash lights, etc.

The wheels of the little plane are magnesium. The engine mount—with but four points of suspension for the engine—is a standard magnesium alloy forging with rubber shock absorbers for the motor. German mechanics are able to make a complete motor change on bombers or fighters with these mounts and the carefully designed control, fuel, lubricant, electrical connections, in less than two hours. Most British or U. S. engine changes mean that an airplane is out of action for at least 48 hours.

The big point of interest is that the ships inspected thus far show how extremely widespread is the German sys-

tem of sub-contracting. On one of the Me-109s it was discovered that 11 different subcontractors had contributed parts. One of the Heinkel He-111Ks inspected in England indicated that 27 subcontractors had supplied parts. This is one of the methods adopted by the Germans to get large-scale production of their aircraft—one that is being adopted in the United States as well.

So much for the Me-109. Here is a tabulation on the Me-110:

Span, 53 ft. 8 in.
Length, 40 ft. 5 in.; empty, 9,900 lbs.
Height, 11 ft.; payload, 4,900 lbs.
Wing area, 414 sq. ft.; gross, 14,800 lbs.

LOADINGS

Wing, 35.8 lbs. at take-off.
Power (take-off) 6.44 lbs.
Span, 4.9 lbs.

PERFORMANCE

Maximum speed, 365 m.p.h.

Range at 15,000 ft.: at 301 m.p.h., 565 miles; 201 m.p.h., 1,500 miles; 175 m.p.h., 1,750 miles.

Obviously this airplane is in another class altogether than the Me-109. It is the best-looking, best-armed, best-built and best-equipped of German fighters investigated thus far—although even better

INTERNATIONAL

Small No. 87 on Me-109's fuselage denotes fuel octane rating; 100 octane fuel has been found in some tanks.

ACME

The "deadly" Junkers Ju-88K bomber has been shot down in numbers by the R.A.F.

machines are said to be in the immediate offing in Germany. The superlatives are those of the British engineers who examined it.

Construction of the Me-110 is all metal, following the general practices of the Me-109, but here resemblance ceases. The pilot has a very complete set of instruments including a huge Paten gyro-compass mounted in the tail with repeater dials in both the pilot's and gunner-bomber and gunner radioman cockpits. The crew can be either two or three—depending on mission. This ship has been used as a short-range fighter, as a long-range fighter bomber and as a reconnaissance ship with cameras.

Automatic wing-tip slots and slotted flaps are standard. Flaps are connected with the adjustable tailplane so that when flaps are lowered the tailplane is trimmed to counteract the change that otherwise would occur in the center of pressure on the wings. At the same time the ailerons are drooped to increase the drag and lift.

All forward-firing armament of the Me-110 is in the nose. A cover that slides forward and lifts off hides four of the rifle-caliber machine guns mounted there. Two 20 mm. cannon are in a trough underneath the belly at the nose. The cannon are loaded by the radio operator-rear gunner from a sliding hatch in the floor at his feet. This gunner has a double machine gun firing backward over the tail. This gun has a field of fire 60° vertical and 120° horizontal and is the only rearward protection.

There are ample engine instruments, a Sperry gyro horizon and turn and bank. The radio includes a short-wave transmitter for Morse or voice, a long-wave transmitter and receiver for Morse only and a loop receiver for homing and direction finding. Finally there is a blind approach receiver and indicator for the Lorenz system. All this weighs 358 pounds and is standard for all multi-motored equipment whether fighter, reconnaissance or bomber.

The maximum tankage for which provision is made is 400.4 gallons or 1,820 litres. Most of the Me-110s, however, have 282-gallon tanks, four in number with one in front and one behind the single spar inboard of each motor. The two front tanks hold 82.5 gallons each and the two aft tanks 58.3 gallons each.

A curious fact is that the landing gear legs are not held up or down by locks as is standard with most other aircraft throughout the world. Hydraulic pressure alone does the job. This probably explains why so many German craft drop an undercarriage leg after combats with British fighters. In the battle a bullet has pierced a pressure line and the resultant loss of pressure releases the retracted leg.

The Heinkel He-111K is Germany's first modern bomber to go into service—

(*Continued on page 64*)

The R.A.F. vs.

BRITISH COMBINE

Commander of an R.A.F. squadron of "Hurricanes," this pilot has been credited with 23 Germans (swastikas on fuselage) and holds the D.F.C.

Literally, the war flies on. These pages contain latest photographs showing the aerial warriors of both sides in action, in victory and defeat.

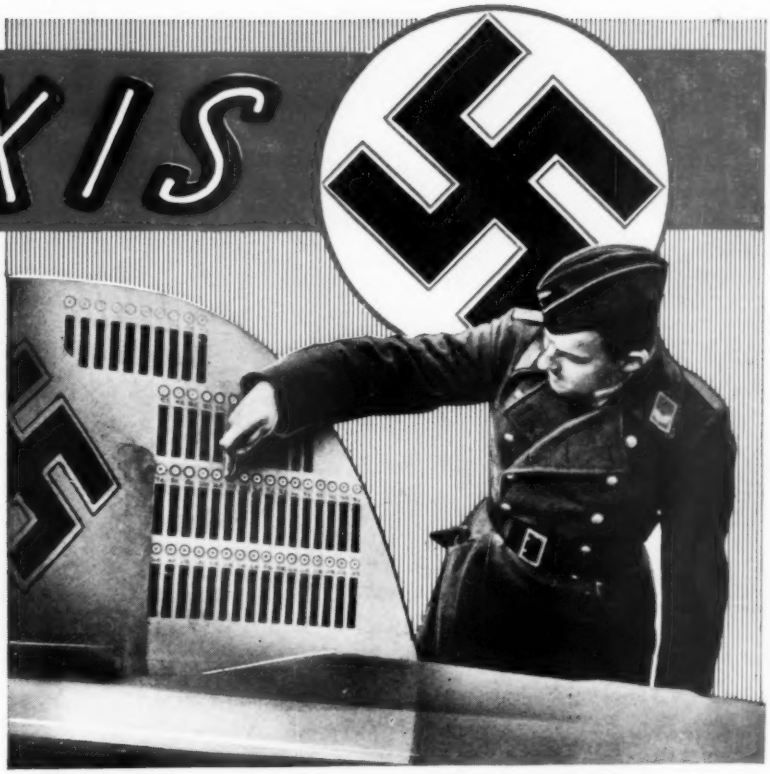
BRITISH COMBINE

About to take off from carrier above are Blackburn "Skua" dive bombers. Also aboard are Fairey "Swordfish" torpedo planes (right) that torpedoed and sank Italian warships in harbor of Taranto.

the AXIS

BLACK STAR

These German mechanics are patching over bullet holes in Me-109 made by "Spitfire."



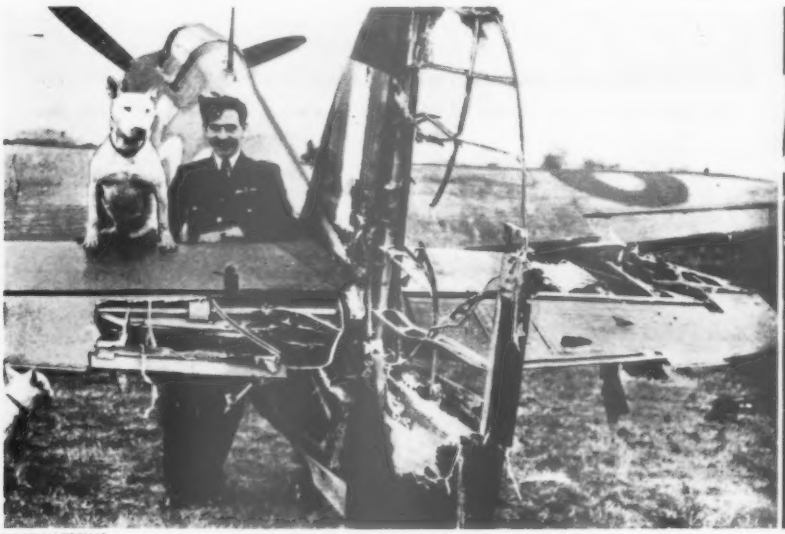
Each of the 54 bars on the tail of this Messerschmitt marks a shot-down British plane.

SCHOSTAL

Bombs dropping from the Italian Savoia-Marchetti SM-79's above are destined for the British base at Malta. Bombardier (right) releases bombs with register-like device.

BRITISH COMBINE

German and British fighters in combat high over London left these white trails. The substance is cloud-like vapor formed by engines' exhaust, causing atmosphere condensation at certain altitudes.



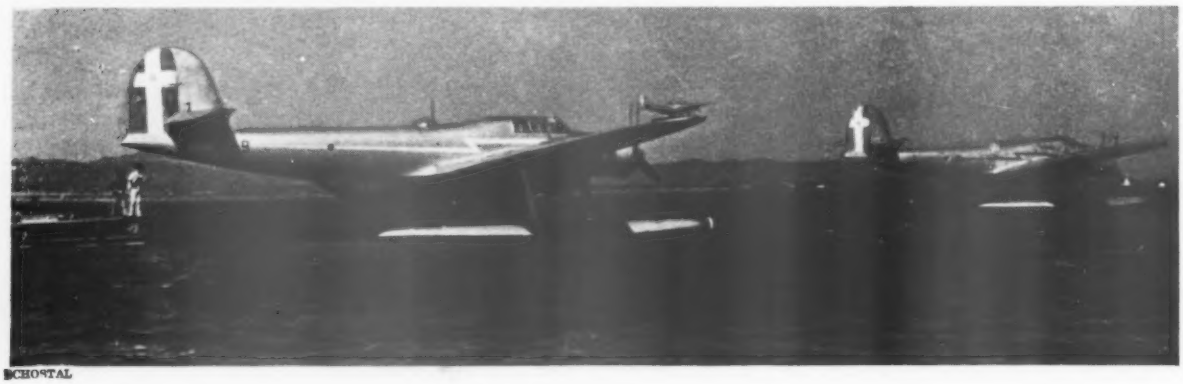
INTERNATIONAL

This R.A.F. pilot flew his ship 36 miles in this condition and landed safely. A Messerschmitt shot away almost all of his "Hurricane's" tail with its aircraft cannon.

BRITISH COMBINE

These are the four .303 caliber machine guns in the power turret of R.A.F. bomber.

Numbers of Italian Cant patrol seaplanes (below) have been reported shot down in the Mediterranean.



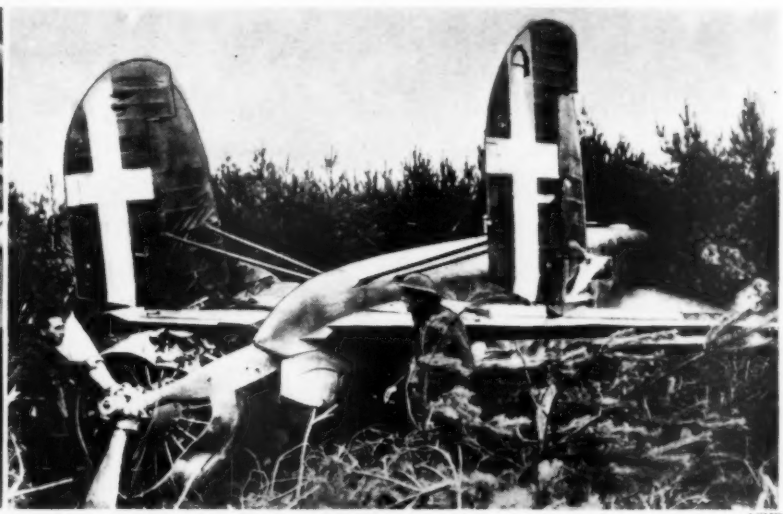
SCHOSTAL

BLACK STAR

Junkers Ju-52's like those above generally are used by German parachute troops. The Ju-52 is an old airliner widely used in Europe; some are in use in South America. They can carry 17 soldiers.

ACME

This unusual picture shows a Nazi warplane packed inside an Italian bomber.



ACME

First Italian bomber shot down in England was this Fiat BR-20. This ship was powered with 1,000 h.p. Fiat engines, had three guns. Note American-built propeller.

Below is first production Consolidated PBY for R.A.F. Unusual gun blister first was shown in April, 1940, issue.

ACME

BRITISH COMBINE

Many bombers being used against Italians by Greeks are French Potez monoplanes. Almost all Greek warplanes were bought from the Allies.

BLACK STAR

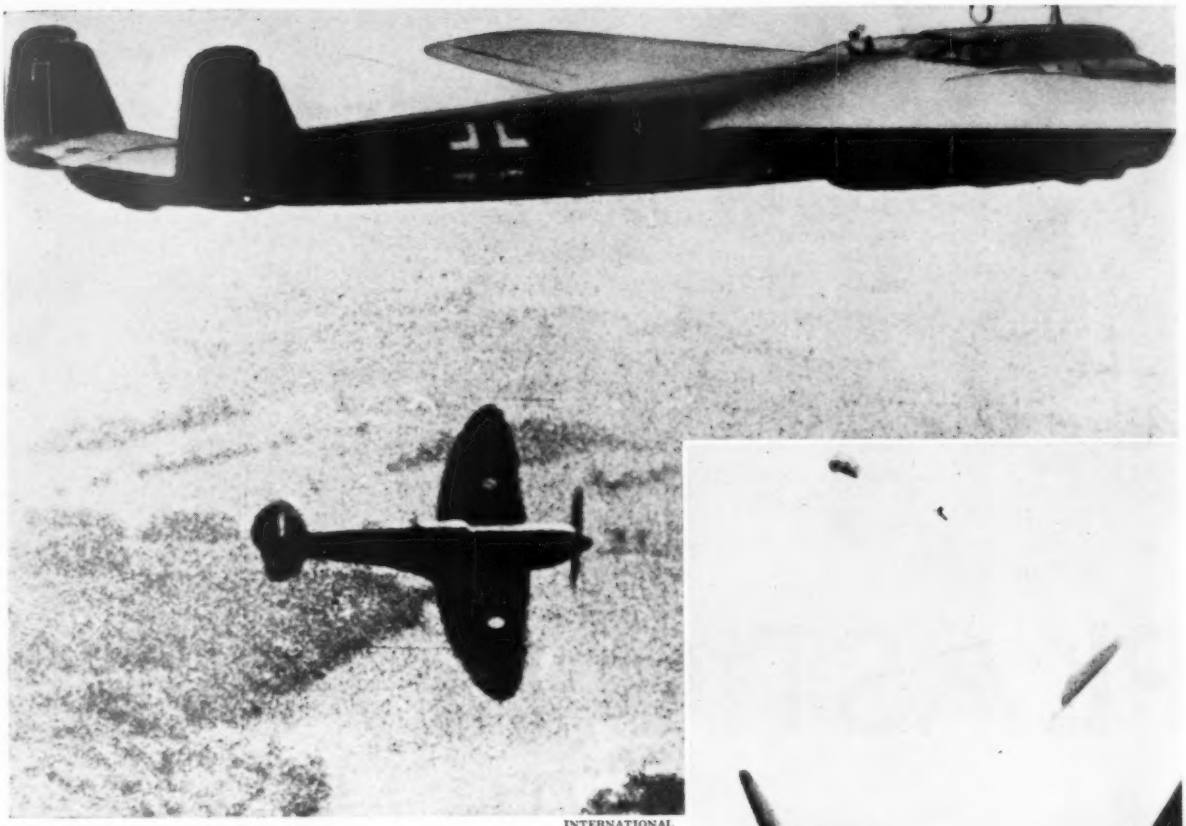
A close-up view of a 20 mm. rapid fire cannon on a Nazi Me-109 is afforded above. Pilot's mascot is a lion cub.

INTERNATIONAL

Shot down by R.A.F. fighters in Africa, this Italian Savoia-Marchetti bomber is going to junk heap.

British air gunners practice by shooting dummy gun at Nazi plane models (note wide selection)

BRITISH COMBINE



INTERNATIONAL

This rare action photograph, taken from another German bomber, shows a British "Spitfire" banking under a Dornier Do-215 raider after firing burst.

One of the war's most striking pictures is that at right showing falling "Hurricane" with wing shot off and pilot bailing out (top center).

ACME

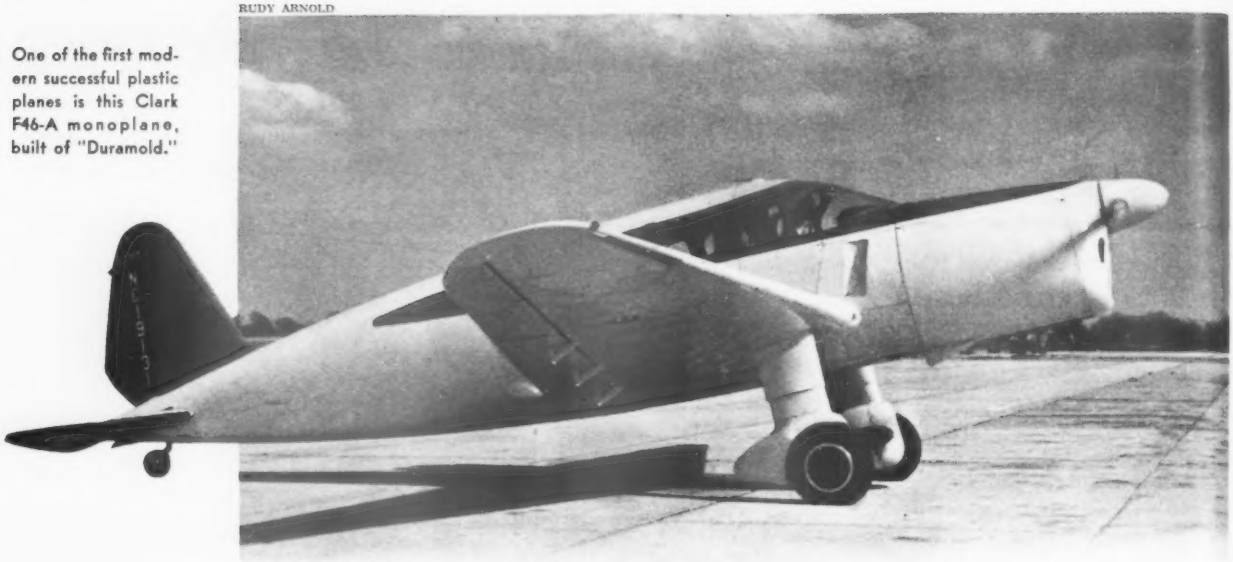
Among newest German warplanes is the Focke-Wulf FW-158 twin-engined fighter below. It is in class of Me-110. Note guns along fuselage.

SCHOSTAL

An officer of the R.A.F. bomber command (below) is pinning tiny flags on a map of the European continent in spots where British bombers have raided Nazi objectives. Notice marked targets in northern Italy.

BRITISH COMBINE

RUDY ARNOLD



One of the first modern successful plastic planes is this Clark F46-A monoplane, built of "Duramold."

PLASTIC PLANES *ARE NEXT*

by A. W. BERNSOHN

With American and British military men clamoring for thousands of warplanes produced at top speed, production men are eyeing plastics.

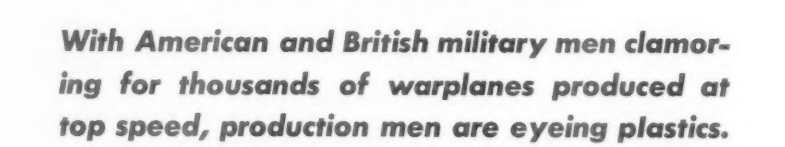
AFTER experts said plywood wouldn't do for airplanes the material ducked into experimental laboratories, took on a new form and emerged today's most rapidly rising aircraft structural material. It's the so-called "plastic" plane.

In those laboratories it found new adhesives, new finishes. They gave it new properties and permitted new manufacturing methods. Result: It's superior to metal in many ways. One of the more important properties, from the military standpoint, is that plywood structures are damaged considerably less by concentrated gunfire than are all-metal airplane structures.

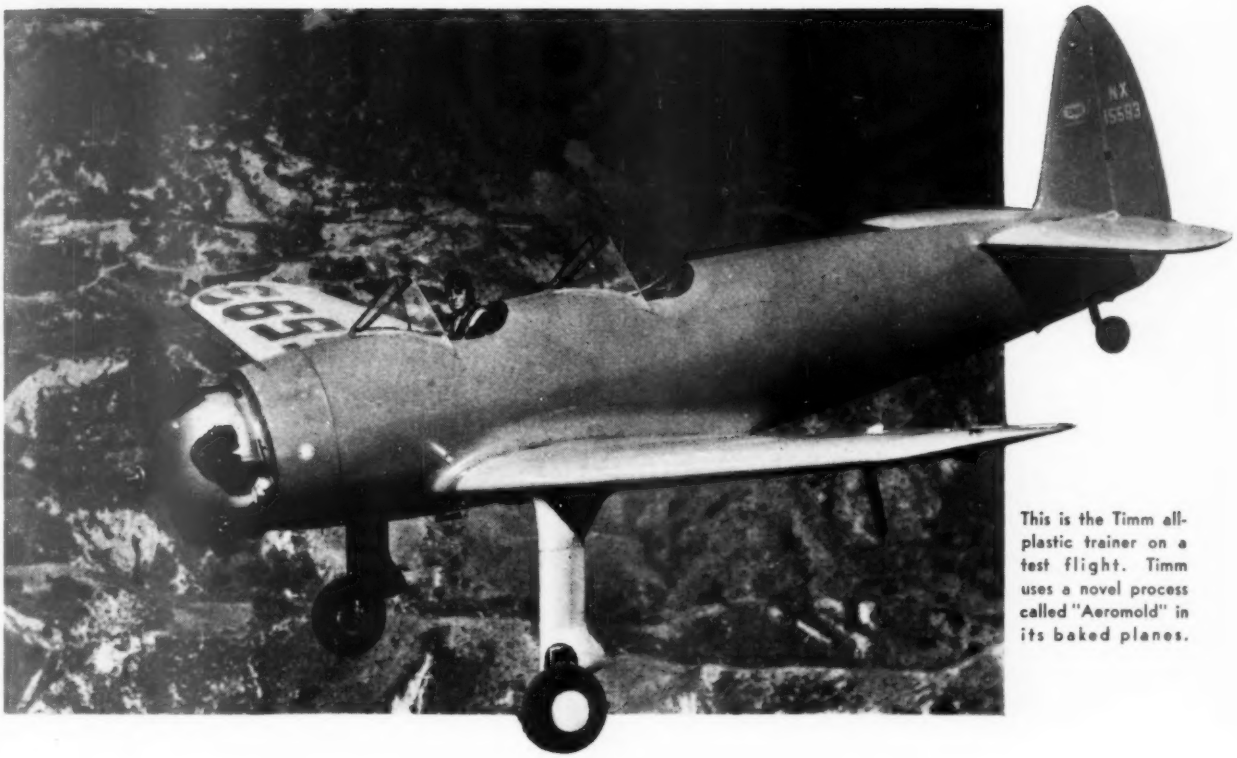
The United States has a tremendous supply of the labor and raw materials that these airplanes require. Cost and production time are hacked 'way down. Even at this stage, in the new plywood airplane's infancy, man hours have been cut 25 per cent. The material doesn't have metal's expensive bottleneck, riveting.

Aerodynamics of plywood - molded planes are tops. Surfaces are satin-smooth, free from the rivets, wrinkles and lap joints which cause 30 to 50 per cent more profile drag than a smooth skin. Well-designed planes with plastic fuselages, wings and fixed tail units, require at least 25 per cent less power at a given speed than comparable all-metal planes. Improved surface of one model showed its cruising speed to be 125 m.p.h. with the same power an ordinary commercial plane requires to travel at 95.

ACME



This is the fuselage of a Timm trainer being wheeled into an oven for baking.



This is the Timm all-plastic trainer on a test flight. Timm uses a novel process called "Aeromold" in its baked planes.

It is claimed by many that plywood semi-monocoque structures are in the neighborhood of being 20 per cent lighter than similar all-metal structures of the same strength. Plastic-bonded plywood structures may be repaired with a minimum of delay and cost; metal aircraft structures do not enjoy these advantages. Often the combustibility of wood is claimed to be a decided drawback to its use in airplanes. The real facts of the case are that when a fire occurs in the air it is generally of such intensity that the matter of which material is best is of no importance. However, with many types of fires, wood has one tremendous advantage. It is a very poor conductor of heat so that the surfaces of beams and thick plywood may burn or char while the inside retains its strength. Steel or dural construction in the same fire and carrying the same load would be very rapidly heated through and not infrequently will buckle and shed its load sooner than the wooden members.

Plywood bonded with plastics bids fair to supersede the prominence of light metals in airplane manufacture, except in the very large plane field and in making those aircraft structures that are subjected to enormously high concentrated loads at points of attachments. Amazing, isn't it? And yet, during the last World War, before the metal plane was developed, plywood raised merry old Ned. It split, peeled, cracked, warped, absorbed moisture and was a pushover for fungi and insects. Part of the trouble then was with the bonding agent. Back then reversible glues were commonly used. Reversible glues are the ones that become hard when dry and soft when re-moistened. Blood albumen was the only non-reversible glue available but it wasn't commonly used. When it was used, the manufacturers found it sometimes stank to high heavens, was usually extremely variable in quality and it stained veneers. So animal and vegetable glues, including soy bean glue, were partially responsible for the downfall of Plywood the First.

The plywood sales graph started to swing upward when certain plywood manufacturers began exercising exacting production control measures in the selection of strong, straight grain, well-cut veneers, so that the resulting plywood would be a uniform product of dependable strength qualities and non-resoluble adhesives were developed that were free from blood albumen's disadvantages. These new bonding materials were the synthetic resins, the far-famed plastics.

An important reason for the new aircraft plywood's recent acceptance lies in the commonly used expression, "stressed skin construction," which describes aircraft structures whose skins carry a high percentage of the loads. Internal structure keeps the skin from buckling and shedding its load. Thin metal sheet is an inefficient material for this construction. It will fail by instability before the material can develop its full strength. Hence the large number of riveted reinforcing stiffeners necessary to support a metal skin against buckling. It is possible, by reason of plywood's low specific gravity, to use plywood skins four or five times as thick as normal all-metal skins without any weight penalty. These thick plywood skins are extremely stiff. They're stable enough against buckling to develop loads utilizing approximately the ultimate strength of the plywood. Plywood's elasticity permits stressing almost to the breaking point without deformation.

Along with the research and study of resin-bonded plywoods, other panel materials were tested. Solid synthetic resins were found to shatter on impact, to cold flow and to be around three times as heavy as wood. Woodflour and woodpulp fillers were tried but lacked the strength required in airplane structures. Molded vulcanite was made with airbubbles in it like Ivory soap, but it lacked strength. Only the combination of veneer's orderly arrangement of fibers and the various plastics' resistance to moisture, temperature and other forces which the wood alone could not withstand, gives the perfect combination we find in the plywoods of today.

Plastics generally employed are phenol formaldehyde and urea formaldehyde, primarily adhesives; the acrylic resins (methyl methacrylates) cellulose acetate and others. This latter has been found to be most useful where strong stress conditions do not exist. These resin adhesives have been developed in the form of powders, liquids and as resin-impregnated tissue paper available in large size sheets.

From plywood was developed the borderline material called "improved wood." This is simply a number of thinner layers of veneer alternated with layers of plastic adhesives. Wood (veneer) has amazingly high tensile strength but is decidedly poor in its bearing strength. Whereas most plastics, such as the

(*Continued on page* 62)

Littlest Line

by EDWARD CHURCHILL

The most unique domestic airline in the United States is 30 miles long and can be traveled in a mere 16 minutes for $5.

IT'S the shortest airline in the world. And, what's more, it's the safest.

We refer to the Douglas *Dolphin*-equipped Wilmington-Catalina Airlines which, for nearly 10 years, has spanned the 29 miles of open water between Wilmington, Cal., and Avalon, Catalina.

Without ballyhoo—it's a very modest organization and doesn't go in for shouting about its records—its planes have, since June 6, 1931, flown the channels more than 38,000 times, have carried more than 200,000 passengers, without injury to a single one. In all these years, there has been just one forced landing—due to a broken oil line.

Now the company is about to reward itself. It is going to expand to 55 miles. It will, instead of originating at Wilmington, take off on one end from Union Air Terminal, Burbank, land for additional passengers at Long Beach and wind up on the island on a first class airport which now is being constructed. This plan, according to a steely-eyed, thin ex-

A colorful spot on Catalina is the old seaplane ramp. The ships are Douglases.

Navy pilot who has "skippered" the airline since July, 1931, and to whom goes credit for its safety and maintenance record—Walter L. Seiler, vice president, general manager, chief pilot and at times just a pilot—is being carried out for two reasons.

Let Seiler tell you. "The first," he says, "is that we want to add to the safety, comfort and convenience of our passengers. The second is that we have come to the conclusion, after a careful survey, that there is no longer any equipment of amphibian type manufactured which is suitable to our purpose."

The new ships (two to begin with) are Lockheed *Lodestars,* already ordered. According to original plans, they were to be delivered in February and placed in service at that time.

"They'll carry 17 passengers, pilot, co-pilot and a steward," Seiler says. "They'll have two-way radio, will be in constant contact with both the Burbank and Catalina (Buffalo Springs) bases and the intermediate stop at Long Beach. We have not had radio up to this time."

That's not all. They'll have a privately financed and constructed airport. This field will have a runway into the prevailing wind of 3,400 feet. The field will be 450 feet wide. There will be hangars, waiting rooms, operations offices and control tower. The buildings will be of old California achitecture. The location, at Buffalo Springs, will be 11 miles from Avalon, will be connected with this main community of the island by a scenic high-speed highway.

Financing of the field has been accomplished entirely by the Santa Catalina Island Company, the Wilmington-Catalina Airline and Philip K. Wrigley. Not one cent of Federal money has gone into it and there is a reason for pointing this out. Note it carefully, and don't say we didn't tell you. Or, better, that Seiler didn't.

Walter Seiler

"Until now we have had only the ramp at Catalina," he says. "Even though there has been no adequate landing place, we have had student flyers and private flyers attempt landings on the island. Successful landings have been made on the golf course, which is privately owned. This is trespass. In each case we have insisted that the pilot dismantle his plane and ship it back to Wilmington by freight. We do this as a safety measure and we will continue to do so even after the new airport has been put into commission.

"We do not want pilots of single-motored ships coming to Catalina over 29 miles of open water. Under the new set-up we will welcome private flyers who have twin-engined equipment which is enabled to maintain altitude even though on only one motor. It will be necessary for the pilot to contact us prior to the flight and get clearance. Under these circumstances, private flyers will be welcome."

Seiler is strictly a safe pilot. He has made 8,400 trips, with just that one forced landing, across the channel. He has carried 44,000 passengers, safely. He knows that there are hundreds of private pilots who would like to fly to Catalina. But, on the other hand, he knows that one motor isn't two. And he has had the experience of seeing in headlines:

"CATALINA PLANE CRASHES IN CHANNEL"

Such headlines *don't* refer to his planes. But a lot of people just glance at the streamers and don't read the full details.

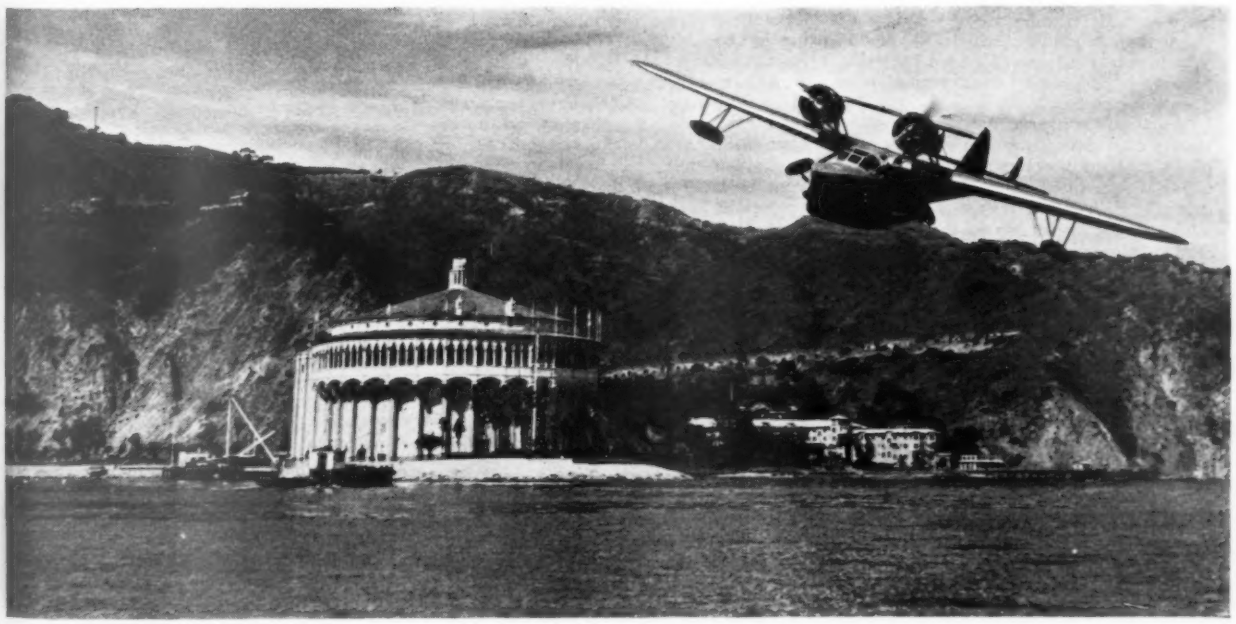
When the Wilmington-Catalina Airline was started under the aegis of the W. K. Wrigley interests, it was pioneering transportation in a safe and sane manner—but it wasn't pioneering aviation. A young fellow named Glenn L. Martin did that on May 10, 1912. He made a couple of headlines himself, because he went over in 37 minutes and came back in 51 minutes, bucking a headwind. Sid and Charley Chaplin, of all people, undertook the first airline in 1919 and their equipment made the first scheduled flight on July 1. Pacific Marine Airways took over on June 7, 1922, later gave way to Western Air Express. Then the Wrigley Company took over in 1931.

On June 6, 1931, the line put into service two Loening amphibians, the belief at that time being that the "amphibs" were best because they could be drawn out of the water, out of the weather, and could be worked on more easily. One month later one Loening was retired and the first of the Douglas *Dolphins* was put into service. Fifteen months from the starting date, a second Douglas *Dolphin* went onto the line. At the moment the airline consists of two *Dolphins,* one powered by two Wright *Cyclones,* carrying eight passengers, and in service nine years; the other carrying 11 passengers with pilot and co-pilot and powered by two Pratt and Whitney *Wasps.*

The fare, at the start, was $5 one way, $10 a round trip. That fare stands today, although there has been considerable experimenting. Seiler says:

"From April, 1932, until March, the following year, we experimented with a one way rate of $3.75. Ordinarily, this would boom business, but it didn't. Business seemed to fall off. We've never learned why. The following year we went up 20 cents and that didn't do much good.

The Wilmington-Catalina "Dolphin" has just taken off for the mainland 30 miles away. These amphibians have made 38,000 crossings, carrying more than 200,000 passengers, without one fatality.



Lately there have been so many boats in and around the harbor at Catalina that the line's amphibians have had to operate to and from their moorings with extreme caution.

We finally went up to $5 and business revived."

The Wilmington-Catalina line never has paid a dividend. In fact, it has averaged a loss of approximately $10,000 a year, year in and year out. There are two reasons. Bringing in Seiler again:

"The line is established as a service to people who want to fly to Catalina Island. It's a convenience. It is, at times, very much a public utility. And, in last analysis, it has been a life saver."

"Second, we've never wanted to carry the mails. We have wanted to fly our own schedules, ranging from one round-trip a day—sometimes cancelled because of bad weather—to 44 trips per day, a peak reached in a summer rush. We were actually running more second sections than regularly scheduled flights. Which points up, too, why we need 17-passenger Lockheed *Lodestars* and new operations bases.

"Aviation transport has shown quite clearly that no airline can operate at a profit without the business of the Post Office Department—and we're no exception."

The corporate set-up of the tiny airline is interesting. David P. Fleming is president and chairman of the board of directors. He has general knowledge of air transportation, but leaves the details to the good judgment of Seiler, vice president and general manager, chief pilot and pilot. Secretary and treasurer is Jack Q. Emmerich, who steels himself to those annual losses, pays off with a smile. Jack R. Hill is the long-time maintenance man—the lad who, with nine skilled mechanics under him, has built up the astounding safety record, who keeps those Wrights and PW's purring, who detects the corrosion which goes with marine air transport.

The line operates in the summer with nine pilots and co-pilots, in the winter with five. Stand-bys under Seiler all are veterans, men who know everything from setting down in a cross-swell or a choppy sea to figuring weather before it happens to them. There's Frank Williams, ex-Navy, ex-TWA, ex-CAA inspector, who is now writing a book about his full life between trips; Harry Downs, ex-Navy, ex-airline, now a Lockheed test pilot once in a while, and Richard Field, ex-Boeing and ex-United Air Lines pilot.

Seiler, out of the Navy himself, not only is a martinet when it comes to operations, but an instructor at heart. So well has he trained his co-pilots that he's constantly losing them. He's proud of the fact that nine of his co-pilots have gone onto the transcontinental lines and have made good. You'll find them spotted around TWA, UAL, Northwest and American Airlines.

Up until now, Seiler's operations have been fairly simple. A pilot, taking off from Wilmington, is checked out. Avalon is notified that he'll be along about 17 minutes later—and there he is. Seiler's operations ceiling is 400 feet, his minimum visibility two miles and he has watched his airline complete about 96 per cent of scheduled flights. Come sunset and the big amphibs are towed up the ramps, put away for the night. Seiler believes in day operations except when you're playing around with potential fog and have no beam.

At Wilmington, a flagman is maintained. If an aquaplaner is cavorting around behind a motorboat, if a barge is being shunted, out comes a blue and white flag that tells the landing pilot, "Proceed with caution." If all is well, he waves a yellow flag. If there's downright danger, he unfurls a red flag. That red flag has been coming out too much of late.

"We get a lot of aquaplaning," Seiler says. "There's more shipping. More private yachting. In short, the Wilmington landing is getting altogether cluttered up. That's just one more reason why we're abandoning Wilmington and going to the landplanes instead of the amphibians."

On the Avalon end there's a patrol boat. And, just in case there might be a mid-channel landing, there are speedboats at both ends of the line—water taxis, they're called—which are ready to scurry out and do duty. There's the other plane, too. All in all, it's been pretty foolproof to date.

"The new line," Seiler adds, "is going to be even more foolproof with radio and all. We're going to reach out and get our customers. It'll be a lot better. We'll stay at Burbank until the other airlines move, then we'll go with them to the Los Angeles Municipal Airport at Inglewood."

There won't be much change in the rate structure, although the passengers will get a longer ride. Proposed fares are $5.50 one way, $11 round trip from Burbank, the same old $5 and $10 from the Long Beach Municipal Airport.

The saga of Walter Seiler is interesting, for the simple reason that the story of the line—and safety—is his story, too. "Walt" is a native of Dayton, O., one of those fellows who had flying born in them. He recalls, as a kid, playing hookie from school to go down to a garage run by "those crazy Wright fellows"—the famous garage at Harshmanville — to "oversee" their latest product.

At 17 he ran away from home, joined the Navy for one cruise, came home, went into the payroll department of White Motors, then went with Packard. He spent more time in the shops than in the offices and developed a natural mechanical ability. Just before the United States entered World War I, two men were being chosen from each state to go to Pensacola for flying training. In Pittsburgh at the time, he jumped at the opportunity, qualified, found Pensacola filled but was shipped to England, where he trained with the Royal Naval Air Service.

After completing the course he went to Dunkirk, flew seaplanes on anti-submarine patrol with the British and French. He returned to the United States, served for several years as an instructor at Pensacola, instructed at San Diego, then patrolled and instructed at Coco Solo, Canal Zone. He went into semi-retirement from the Navy, became chief test pilot for Emsco in 1929. When this company ceased operations he concluded, at 40, that he might as well retire. It was with this in view that one day in June he stood studying the Wilmington Catalina Airline operations at Avalon. A man beside him began talking to him.

"Pretty nice, isn't it?" said the man, indicating the ramp, hangar and planes.

"Yes," agreed Seiler, "but I think—"

He went into a few suggestions with considerable air-marine terminology. The man's mouth fell open.

"Say!" he exclaimed. "How do you know so much about this?"

That started something, because the

(*Continued on page 78*)

We Buy a Used Plane

by JACK ROWLEY

Photographs by the author

This article is by a typical private pilot who searched the market for a used airplane. He learned a few things and gathered some advice that should be valuable to you.

IF you have $50 cash and a pilot's certificate, you can buy and fly your own airplane tomorrow. Find three friends with $50 apiece and you're on your way. Two hundred dollars and a good credit record will make the down payment on an $800 ship. There are plenty of banks or airplane finance companies who are happy to make such loans. The balance can usually be amortized into monthly installments.

"Why buy an airplane?" you say. "Isn't it cheaper to rent time, pay $5 to $9 per hour and avoid the worry and expense of maintenance, repairs, depreciation and hangar rental? Do not two out of three people that buy planes, resell after six months to a year of ownership? Should a private flyer own a ship if the press of business permits flying only one or two days per week?"

It's like the old story of home ownership. Is it cheaper to rent or buy? If you have spent hours at an airport waiting your turn to rent a ship for an hour or two, you might change your mind. Recently flying time rental was increased. Where 50 h.p. time cost $5 per hour, it now is $6. Before the rise, check time and dual instruction was free. It now costs $2 per hour. Demand and CAA student training caused the rise. Flight instructors must be guaranteed a decent income. The operators want to cash in.

The rough treatment given training ships by some students causes the careful flyer to wonder about the actual day-to-day condition of the aircraft offered for rent. Most operators check their ships daily and weekly. But the story gets around about the motor that fell off a ship — fortunately after the pilot had landed and was rolling on the ground. And all but two strands were broken on the rudder control cable of another ship. While the majority of operators are extremely careful, the neglectful few raise doubt about all. Today's light airplane is the "frugal McDougall" of transportation. The average 50 h.p. ship can be operated for less than 80 cents per hour. Two people can travel for one cent per mile. Average care in cleaning and waxing will preserve airplane fabric indefinitely. Fifty hour checks cost but a few dollars. Hangar rentals vary from $5 to $15 per month depending upon location. The growing business of the lightplane manufacturer is evidence in itself that the number of private owners is on the increase.

You can fly anywhere and any time you please, weather permitting, when you own your own airplane. You can fly for as long as you wish. Careful selection of the members of your flying group assures your ship of always being in proper flying condition. A ship that is well cared for is a pleasure to fly.

"But I have never bought an airplane," you say. "How can I tell if I am making a wise purchase?"

Listen to what Charles Babb of Glendale, Cal., has to say about buying used aircraft. He is famed as the largest used airplane dealer in the world. We asked Mr. Babb why people buy used airplanes.

"They buy used airplanes to do a definite commercial job. Or for pleasure flying, the motive is to enjoy the sport of flying, the thrill of getting in the air, or the study of a new art," he replied.

We queried him as to the factors to be considered in selecting a ship. "Performance alone is specification No. 1 for purchase. Speed, time and distance, or the performance of each individual aircraft are the factors to be considered. Will the ship fulfill the requirements of

The photograph at the top of this page shows the author with the used plane he recently bought.

Since there is such a wide variety in aircraft, the only logical, business-like way to purchase a plane is to make up a comparison table in your mind or put it on paper.

the purchaser?" Babb wants to know.

"Each particular aircraft has its own worth. However, a valid certificate of airworthiness is virtually a guarantee of the airworthiness of an aircraft. Hours on a plane are only the measuring stick of the wear and tear accomplished. The life of a ship may be indefinite if it is properly maintained and all worn parts replaced or rebuilt," Babb concluded.

Since there is such a wide variety in aircraft, the only logical, business-like way to purchase a plane is to make up a comparison table in your own mind or in black and white on paper. Decide what your own requirements are for speed, time and distance. If in doubt about performance of aircraft considered, refer to a table of civil aircraft specifications. Next begin a comparison of price and performance of ships under consideration for purchase.

Ships in the 40 h.p. class range in price from $500 to $850, the average being $650, depending on time on the ship and condition of motor and fabric. Planes in the 50 h.p. field cost $850 to $1,500 with the average at $1,000. Sixty-five h.p. performance in a light ship runs from $1,200 to $2,400. Ships in the Class 2 field offer a much wider range in cost and performance.

Compare the performance and cost of operation between Class 1 and Class 2 ships. The light ship burns 3 to 4½ gallons of fuel per hour, with a cruising radius of 300 to 400 miles. The light ship lands slower and easier for a pilot with only a few solo hours in his log book. Major and 50 hour checks are cheaper. Hangar rentals are less. The light ship is ideal for training and preparation for various pilot ratings. Many long flights are taken in light ships.

In the Class 2 field, 75 h.p. to 100 h.p. ships burn 4½ to 7 gallons of fuel per hour. Faster performance may be expected. They're better adapted for cross-country flight. The cars on the highway don't pass the Class 2 plane in a headwind. It plows right through thermals and gusty air that bounces light ships all over the sky. Experienced pilots will tell you that if you can handle a Class 2 ship properly you can learn the big ship "feel" —you can fly anything after a small amount of check time.

When you get down to actual selection of a ship, inquire about the number of hours on the motor and aircraft. Ask to see the log books. Inspect them carefully and note all entries. There is one for each plane and engine. They tell the life history of the aircraft; where, why and how the ship was used.

You might be told that part or all of the log books are lost. While log books often are honestly lost, it is wise to use extra precaution in inspecting such ships; price alone does not make a bargain. It's better to pay an unbiased aircraft mechanic a fee to inspect a ship than to buy blindly.

Find out when the ship comes up for relicensing and what work, if any, is needed to assure a new ticket. Punch and pound the fabric, carefully examining its condition. It costs up to $200 to recover any airplane. Look over the finish. Note the number of instruments or the lack of them; they add or subtract to the aircraft's value and re-salability. Inspect the tires and the tail wheel, landing gear, brakes, struts, cables, pulleys, fittings and turn buckles. Twist the wing tips to see if there is any evidence of broken spars or ribs. Open up the inspection panels. Look for any possible damage. Use a flashlight inside the fuselage and look for any evidence of cracking, rust or corrosion. Check the entire ship for any clue or indication of structural injury.

Check the propeller condition and appearance. Pay an unbiased aircraft mechanic a fee for his opinion on the engine. Move the ailerons and elevators, wiggle the rudder, roll the tabs or stabilizers up and down, noting their action.

Then fly the ship yourself. Make sure it handles to your satisfaction; that the controls are not too stiff or sloppy; that the ship has no undesirable flying characteristics. Get it upstairs, trim it and see how well it flies "hands off." A few hours' flight and comparison with other ships you have flown will tell you whether or not it's the ship you want to own.

On the ship or ships under consideration, list the performance, motor's r.p.m. on take-off, rate of climb, top speed, cruising speed, service ceiling. Check the power specification, horsepower, fuel capacity, fuel consumption, radius of action, propeller size, motor maintenance cost, oil consumption and capacity, cost of an oil change.

Find out the cost of 50-hour checks, amount of time on the motor, the prospective time to a top overhaul, cost of a top overhaul, time to a motor major and its cost. Costs vary considerably on different type motors. The light four-cylinder motors are much cheaper to top or major than a big radial motor.

Get all other facts as far as possible. What are the total dimensions and wing area? Hangar rents are based on the amount of space a ship occupies. What does the ship weigh? Individual planes vary considerably from the manufacturer's original specifications, depending on the number of additional accessories, equipment, instruments or extra gas tanks. A new coat of paint may add 20 to 40 pounds. While adding value, performance is reduced.

If a ship is purchased on installment contract, insurance is usually required. Common policies purchased are the 90 per cent retention form. This covers 90 per cent of any damages done in flight, fire, partial damage, etc. Usually this type of policy covers all fire damage on ground. Premium costs for 12 months coverage averages 11 per cent of the value of the ship. To get full and complete figures an aircraft insurance underwriter should be consulted.

The advisability of buying a ship that has been damaged or cracked often comes up. It is generally conceded that a properly repaired ship is okay for purchase. It is virtually impossible to find a ship for sale that has not at least had a wing tip scratched.

If a damaged ship has been repaired by a reliable, reputable repair station it must, on completion of work, receive the approval of a CAA inspector. All proper notations must be entered in the ship's log and signed by an aircraft mechanic (who includes his license number). Questions about past work performed on an aircraft can be settled by reference to logs or the shop's work-order sheet.

You can have a lot of fun picking out your own ship. You don't have to be rich to buy and fly.

END

Weld It Outdoors

IN cold weather aircraft welding should be done outside the hangar, according to a warning issued by Aero Insurance Underwriters. This warning is issued because there have been so many fires caused by such work, despite the fact that every logical precaution has been taken. However, in welding out of doors in cold weather, care should be taken that the weld does not cool too quickly; this may cause it to crystallize.

THE CPTP . . . ?

Thousands of lightplane-trained pilots have been graduated by the CPTP in one year.

by Virginia Withington

Is the pet program of the CAA about to be curtailed or possibly discontinued entirely? There are indications in Washington that drastic changes are coming.

BY the time this appears, the Civilian Pilot Training Program, launched not quite two years ago and now a familiar part of aviation, may have been changed beyond recognition. Under the impact of the Army Air Corps expansion and present national policy, the CPTP is being turned from its original purpose of encouraging civilian flying toward service primarily as a feeder of pilots to the Army and Navy.

Last spring, in an effort to adjust itself to the times, the Civil Aeronautics Board introduced an advanced training course designed to fit students for the armed services' secondary courses. This process of adaptation is another step with the budget for 1941-42, in which CPTP funds are cut sharply. Under this budget, only $18,000,000 is to be spent on civilian pilot training, reducing the number of elementary pilots graduated from 45,000 to 30,000, the advanced, from 9,000 to 6,000. With this, it is agreed in Washington, will come changes in the nature of the program itself.

Civilian pilot training at Government expense was begun on an experimental basis in the spring of 1939 with National Youth Administration funds to see whether the Government could fill what aviation had long felt to be a grievous need. Some way had to be found to bring together young men and women with enthusiasm for flying and the planes they could not afford.

At first it was thought that the answer lay in the establishment of seven great training centers. Robert H. Hinckley, now Assistant Secretary of Commerce in charge of aeronautics, and then a member of the CAA, countered with the suggestion that the program be dispersed as widely as possible. He urged that advantage be taken of existing facilities,

(*Continued on page* 58)

Favored above lightplanes are military-type secondary trainers like this Waco.

THE NEGRO IS FLYING

No gasoline pumps are available at Tuskegee's "temporary" airport. This makeshift platform is the refueling site.

by Manning Austin

Air-minded Negro youths have fought their way into aviation despite great odds. Theirs is a story of perseverance.

WITH four phases of the CAA's Civilian Pilot Training Program in operation and courses in private flying and aviation mechanics practically assured for the fall term, Tuskegee Institute at Tuskegee, Ala., is becoming a center of Negro aviation.

Tuskegee—the world's largest Negro college—is located in the warm, flat country of the Deep South, the earliest home of the Negro in this country, where ideal flying conditions prevail the year around. The school's aviation program, under the direction of President Fred L. Patterson and Director of Mechanical Industries George L. Washington, began the year very favorably. The Institute has:

1. Increased its fleet by two Wacos and two *Cubs*, bringing the total to four Wacos and eight *Cubs*.

2. Completed the training of eight apprentice instructors from Tuskegee and four other colleges and contracted with the CAA to give a refresher course to five other qualifying Negro instructors.

3. Pushed to completion an alumni drive to raise $3,000 toward building an airport and aviation mechanics building on its own spacious campus.

4. Enlarged its primary training program from groups of 15 and 20 to three annual groups of 30 students and trebled its secondary program to include 30 students from seven Negro colleges.

Without even an airport, the Institute began its aviation program December 1, 1939, when the CAA awarded it a unit of the Civilian Pilot Training Program. Initial flight training was given at the Montgomery airport, 40 miles away. Ground school training was given at Tuskegee.

Because it had not a landing field within the required 10 miles, Tuskegee at first faced the prospect of being denied the primary training program which the CAA had awarded to 400 other colleges. Director Washington went to Washington to appear before CAA officials with a special plea for Tuskegee's aviation future. He explained that should the CPT program be denied Tuskegee, aviation training would be lost to the Negro race in an area where there is the heaviest Negro population in the United States. The CAA granted Tuskegee an exception and its aviation program was assured of a start.

After December, 1939, the program expanded rapidly. Tuskegee students set a record among colleges in the south by passing 20 out of 20 students in the ground school of the first (1939-40) class, then sending a quota of 20 through the flight tests to receive private pilot certificates. Last summer's class of 15 students and a quota of 20 for the fall class were graduated and a new class of 30 began its training in January, 1941.

Tuskegee was the first Negro school to be selected by the CAA for a secondary aviation program at which students from

These advanced CPTP students at Tuskegee are standing in front of the school's monument to Booker T. Washington.

five Negro schools would continue their training. The first class was held between July 15 and September 15, 1940, another class was held in the fall and winter and a third group started early this year. A quota of 30 was set for the secondary training program begun in February, three times the number of students in the previous classes. During the 1940-41 program, students from Tuskegee, Virginia State College for Negroes, Lincoln University, Howard University, West Virginia College, Agricultural and Technical College of North Carolina and Hampton Institute were trained.

The flying ability of the Negro youth was demonstrated in the first primary flying class according to J. Wren Allen and Don S. Porter, white instructors of the Alabama Air Service, Montgomery. Porter and Allen were also instructors in the early programs at Alabama Polytechnic Institute at Auburn.

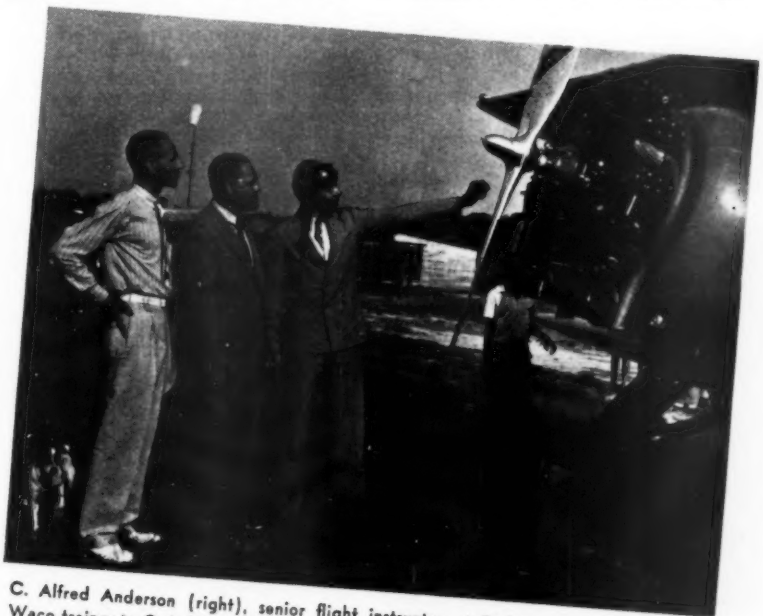
"These boys have a lot of ability and are doing fine work," Allen remarked during the training period. The colored youths practiced taking off and landing on a small field, closely bounded by trees on one side and a highway and wires on another side.

"You can see that if they can fly from this field, they can fly anywhere. Every landing is a spot landing here," Allen said.

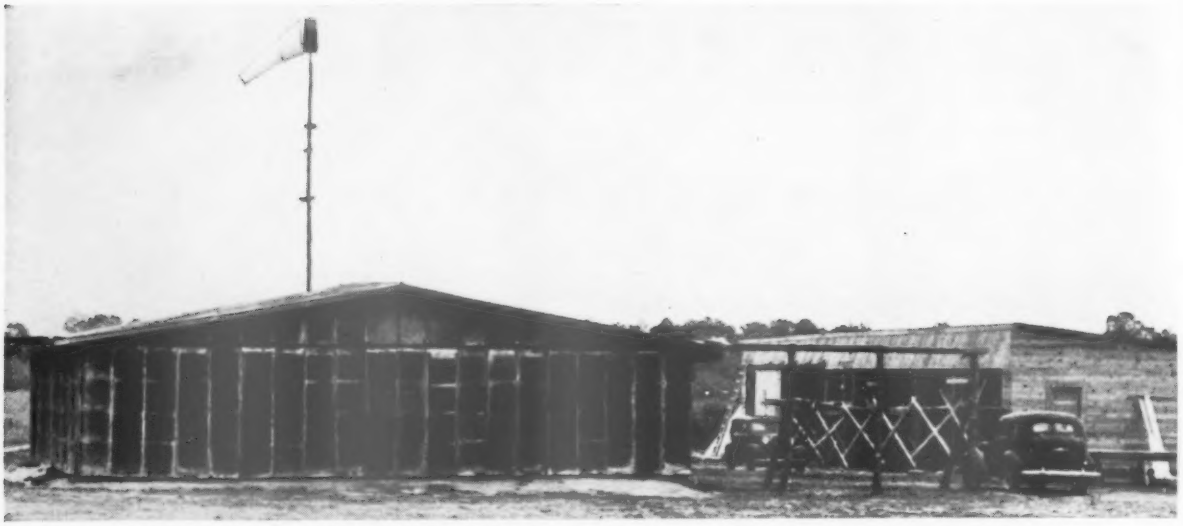
Floyd B. Brinkley, chief of the Publications and Statistics Division of the CAA, said of the Negro flyers: "Our field representatives say that the Negro trainees have been 'fairly good' and the average of those completing the course, on a percentage basis, has been only slightly less than the average of the white students completing the course."

Tuskegee students were then using a field leased by the school and improved by themselves. The 80-mile-a-day Montgomery trip had been discontinued. Director Washington said the trip was too expensive and required too much of the students' time. This was only one of the out-of-town fields used by the colored flyers. For a time the secondary students used the field of Alabama Poly at Auburn.

Washington, who was appointed director of the CPT program at Tuskegee, is a native of Virginia and is trained in automotive and mechanical engineering. He received his B.S. and M.S. degrees at Massachusetts Institute of Technology.



C. Alfred Anderson (right), senior flight instructor at Tuskegee, describes a new Waco trainer to G. L. Washington and Dr. F. L. Patterson (center), Tuskegee president.



CPTP students at Tuskegee, under the direction of a lone carpenter, built this two-plane hangar themselves. This was one of the requirements of the CAA before granting a training unit to the school.

Now in his thirties, Washington has asserted devotion of his life to training members of his race and prefers that it be in the south, where Booker T. Washington founded Tuskegee in 1881. A precept of the founder as to practical training is still followed at Tuskegee. Students are required to work in private industry one-fourth of their schooling period, for which they receive college credits.

Having received a CPT scholarship Washington took flight training with his students, soloed in September, 1940, and received his private pilot certificate a short time later. He hopes to continue flying.

An important step in Tuskegee's aviation program came last July 3 with the purchase of a Waco trainer for use in the advanced CPT program. Tuskegee then became flight contractor as well as ground school contractor to the CAA. Two *Cubs* were then in the school's hangars.

President Patterson announced: "Secondary training in aviation for Negro youth will be centered at Tuskegee Institute, and this training will begin July 15. The program is under the Civilian Pilot Training activity of the Civil Aeronautics Authority and culminates months of effort and planning on the part of Director Washington and me. Director Washington is heading both the primary and advanced Civilian Pilot Training programs at Tuskegee."

He added: "For the 1940 summer session, consisting of eight weeks of intensive training, the CAA has awarded 1,000 advanced training scholarships to white and Negro youth throughout the country. Top ranking private pilots who completed the primary training during the 1939-40 CPT program and who were successful in passing the physical examinations conducted by flight surgeons at Army or Naval air bases were selected by the Washington office and assigned to training centers throughout the country. Each of the some 400 colleges was permitted one student and an alternate for each of its 10 students in its 1939-40 quota.

"Students assigned to the Tuskegee center will hail from primary units of Howard University, Hampton Institute, West Virginia State College, Agricultural and Technical College of North Carolina and Tuskegee."

Of the advanced training program, Director Washington said: "Tuskegee is among a very few institutions, regardless of race, to own and control facilities for flight instruction. While 400 colleges during 1939 and 1940 had primary programs under which ground instruction was taught at the college and flight instruction was contracted out to commercial flying schools, the advanced training was restricted to about 60 centers, mainly commercial flying centers of long establishment."

To flight-train the Negro youths from these five colleges, Tuskegee procured the services of two men well-known in Negro aviation—C. Alfred Anderson and Louis A. Jackson. Anderson, senior instructor, is the first Negro to be awarded a commercial pilot certificate. Immediately before coming to Tuskegee, Anderson enrolled for a course in aerobatics at a Chicago school.

By January, 1941, Tuskegee had added three other flight instructors to the staff of the school. They were Joseph T. Camilleri and Frank Rosenberg, white, of Brooklyn, and George W. Allen, colored, of Latrobe, Penn. Their services were required as new phases of training were introduced at Tuskegee and still further additions to the aviation faculty will be made before opening of the fall term of school, Washington said.

In 1939, when the CPT program was begun, there were 23 Negroes in the United States holding private pilot certificates, four holding air transport certificates and four limited commercial certificates. In September, 1940, the number of Negro flyers holding private pilot certificates had risen to 97; seven held commercial certificates and two held limited commercial pilots' certificates.

By the fall of 1940 each of the five Negro schools had Negro flight instructors. A non-college project, offering flight instruction to Negroes, was sponsored by the Chicago National Airmen's Association and enrolled 29 students. It had a Negro instructor. Altogether 114 Negroes had completed or were enrolled in the college and non-college programs late in 1940.

Tuskegee's ground school staff, besides Washington, is composed of Lieut. B. M. Cornell, retired Naval flyer who is professor of aeronautical engineering at Alabama Poly; Robert G. Pitts, assistant to Lieutenant Cornell; and William C. Curtis, head of Tuskegee's electrical division. Cornell and Pitts are white; Curtis is colored.

Two days after Patterson signed the flight contract with the CAA on July 13, 1940, the ground course and controlled flight course was started. They ran concurrently until September15. The ground course included aerodynamics and aircraft, Civil Air Regulations, engines, instruments, meteorology, navigation, radio aids and facilities and physical education.

In the flight course 40 to 50 hours of dual and solo flight instruction was given. Alabama Poly allowed Tuskegee to use its landing area. A station wagon was provided to transport trainees to and from the landing area. Ten students were enrolled in the course. Three were Tuskegee students who received their private pilot certificates in the 1939-40 program. Khaki uniforms and insignia of the CPT became the official attire of the trainees.

As part of its training, the class was taken to Montgomery for an inspection of Air Corps base at Maxwell Field and to Pensacola, Fla., for an inspection of the Naval Air Base.

Washington says: "The outstanding record of Tuskegee students on the CAA written examination may be attributed to the strong ground school staff." Two of Tuskegee's students scored among the

(*Continued on page* 74)

Conrad at the controls of his plane.

HERO FROM WINONA

by

Betty L. McKelvey

Max Conrad is one of those pilots who does not say much. But there's talk of giving him a medal for life-saving with his plane.

A PROPHET is without honor in his own country, said the ancients. Of course, it's hard to make good on the home field but Max Conrad, who has been plugging for aviation in his home town—Winona, Minn.—since 1928, has proved it can be done, even in the flying business.

Right now the tall, dark-haired flyer has all the "honor" he can use, for he is unquestionably Hero No. 1 of his home town and his name has been news in the middle west since he saved the lives of a couple of dozen duck hunters caught napping by the Armistice Day storm.

Conrad probably doesn't put much stock in this sort of honor, however, for he remembers how, not so many years ago, he did an exhibition parachute jump to help pay for his first parachute—cost: $375—and was able to collect only $19.50 from a crowd of about 10,000. Next day, a full-page "in appreciation" ad appeared in a local paper. It cost the donors $100.

"It was nice of them, but if they'd only given me the $100 instead—or even half of it," he says today, ruefully. He had plenty of honor, then, but cash was scarce.

Right now, however, after a good many year's work, Conrad has something more substantial than public praise: a chain of midwestern airports and air schools, a sort of "chain school of the air." At his Winona airport he handles three CAA courses: St. Mary's College, State Teachers College and St. Teresa's; at his Eau Claire, Wis., airport, the Eau Claire State Teachers College; at Green Bay, Wis., St. Norbert College; in St. Paul, Minn., St. Thomas College. He expects to start operating at Notre Dame University in February, with or without a Government contract.

Conrad appears to have two general purposes in forming this air school chain: first, to prepare jobs as airport managers and teachers for the outstanding flyers he develops in his classes; and, second, through these airports, to line up charter trips for himself.

He is especially interested in helping young people with talent get the necessary training in aviation. He helps finance or finances entirely the training of many young men, expecting partial payment from them when they begin to earn a living through flying. Many continue, of course, to work for him.

"I enjoy teaching," he says, "because I like to watch the progress of young flyers."

Conrad (center) poses with a group of his students before a cross-country hop.

He trains all of his own instructors so that he will know all about them "aeronautically and personally" when he sends them out on a job. His own work will eventually be supervisory, although he plans now to handle the school at Notre Dame personally. He will continue to check his instructors' work, train instructors, make charter trips and give flight tests, for he is a flight examiner.

He has already taken steps to establish a complete airplane repair station at Winona, with 24-hour service.

To date Conrad has soloed 637 students and at last count had 14,389 air hours. He has flown over a million miles.

Conrad's family probably was not surprised when he turned to matters mechanical for his livelihood. He gave evidence of such tendencies at a tender age, when he used to stand on a kitchen chair beside the family car and take its engine apart. Now he is a licensed airplane mechanic as well as aviator and teacher.

His college career was decidedly checkered. He attended several colleges, including the University of Minnesota, Notre Dame, Marquette and Southern California. At the University of Minnesota, for example, he started taking a course in Naval Reserve work, in which flying was to be included. He attended classes for a while but his impatience to get at the actual flying drove him to quit school. He went out to Eagle Rock flying school in Denver, where he soloed under Cloyd Clevenger. Then he bought an airplane and started to build up hours.

Perhaps it is because of some of the experiences that grew out of his early

The makeshift, snowbound shelter in the upper left hand corner of this photograph is one that Conrad spotted with his airplane, then guided rescuers to the hunters.

impatience that he is so anxious to see that his boys are at least partially seasoned before he sends them out. Too often, if this precaution isn't taken, students meet some unexpected problem that breaks them.

"All the boys want to grow too fast in flying," he puts it.

Conrad founded the Winona airport in 1928 by the simple process of landing his plane in a field near the city. The field has gone through various stages until now it is a well-ordered airport, with more business than it can handle. A total of 18 planes belonging to the school now operate out of the home field and the organization owns, to date, 23 airplanes. Twelve more are on order.

It was typical of Conrad that, while attending Notre Dame, he conducted a flying service on the campus, teaching and giving charter service. It would doubtless be safe to say that the service got more attention than his regular studies. When Conrad first came back to Winona to fly commercially no one would fly with him. That, he maintains, is the main difficulty of trying to build up a flying service in the home town.

"Everyone knows you," he says, "and all your weaknesses, and can't be convinced that you could possibly know your business."

He went to Tulsa, Okla., and got a job as a test pilot at the Spartan factory. Although all he did there was to fly a Spartan from seven to 10 hours a day to see how long it would wear, this job convinced Winonans that he did know how to fly and business perked up.

At one time Conrad started an airline running from Winona to Rochester, the Twin Cities, Duluth and the Iron Range country. This attempt was short-lived, since it was started at the beginning of the depression—and the firm did not hold an air mail contract. Conrad watched the business dwindle and wondered what he was going to do with his two Ryan B-3's, still unpaid for. To pay for them he flew charter trips to California once a month, putting ads in stores and shops all over town and calling the trips "conducted air tours."

He has always made a lot of charter trips. Last summer, for example, he flew Benny Goodman and his party from Rochester's Mayo clinic into Canada. For this trip he used his Stinson *Reliant*, but for smaller jobs he often uses his Stinson "105."

Some years ago he took an elderly man from Minnesota to California. The man was delighted with the trip and when, seven or eight years later, he wanted to come back to spend his last days in Minnesota, he would come with no one but Conrad.

Conrad does a lot of flying for the Mayo clinic. A few years ago a well-known Rochester specialist received an urgent call from a small town in Minnesota and summoned the Winona flyer. When they were well on their way there was a sudden change of weather and it started to sleet and snow. By the time they reached the little town it was night—and there was no airport. Citizens of the town had lined up a lot of cars, by the headlights of which Conrad was expected to land. The only difficulty was that the cars faced the wrong way, so that he had to land toward the glare. He slipped down to about 100 feet in his Ryan B-5 and started to come in for a landing. Suddenly, right in front of him power lines loomed up and, in trying to avoid them, he struck something—he didn't know what. There was an awful moment when he thought the ship was going to stall but it took the gas and he went upstairs to think matters over. The doctor, who had been in front with Conrad, was bundled into the back seat and barricaded with pillows. But the precaution proved unnecessary, as the landing was made without much undue difficulty.

On landing, the pilot found that he had torn off a tire on the top of a telephone pole. He replaced it with an auto tire which fit and returned to Winona. Incidentally, the patient had nothing but a bad headache.

Conrad is very firm with unthinking students or bystanders who are careless about propellers. A propeller nearly finished his own flying career. Once a woman, her mind intent on some other matter, walked into one and, in an attempt to save her, Conrad was struck. There were long weeks in the hospital and then he went back to work. It was no use. He didn't have proper coordination and sense of touch and was so nervous that, when a student failed to do well, Conrad would go all to pieces.

He went to California to recuperate from a bad case of nerves and it was there that he became even more devoted to an early love: athletics. He spent much time at the Los Angeles Athletic Club and, in the early 1930's was national high jump champion. For a time he went about the country doing exhibition work with a group of athletes including Vern McDermott, then Big Ten pole vault champion; and Bob Maxwell, national low hurdle champion. They flew about the country and it was at this time that Max made one of his most eventful forced landings. The men were returning to Los Angeles from Phoenix when an exhaust valve broke off, forcing them to land in the middle of the Harqua Hala desert in Arizona, about a hundred miles west of Phoenix. The temperature was 120° in the shade. Their supplies consisted of a box of candy. They bought a five-gallon can of water for $5 from a man in a Model T and tried to decide what to do.

They finally disconnected a cylinder and the exhaust valve mechanism and flew back, although it was necessary to reach 8,000 feet to clear.

Conrad has continued this interest in athletics through the years. In fact, last year he won the Winona city handball championship. He likes surfboarding, jumping and various other sports and has a jumping pit at the airport which he encourages his young flyers to use. They have even organized football teams.

Unlike many professional flyers, he has found parachute jumping interesting. He has made six jumps. He remembers that he was not at all nervous at the time of his first jump because he was so busy trying to calm the student who was flying the plane for him.

"It was a pull-off," says Conrad. "I had bought the chute and the book of instructions, but I knew so little that I didn't even realize that it was necessary to pull the ripcord 'way out before the 'chute would open. I pulled it out part way, standing out on the wing, and was congratulating myself that I had not jumped because (I thought) the thing wasn't going to work. The cord came out the rest of the way and all of a sudden there was a jerk and there was the ship, two blocks ahead of me."

Conrad has a lot of interests outside

(*Continued on page* 80)

I LEARNED ABOUT FLYING FROM THAT!

No. 22

The author, now an airline captain.

"We were flying Curtiss F7C-1's, a nice ship . . ."

by CAPT. FRED SMITH

Slipstreams are dangerous, especially if you inadvertently get your plane caught in one. The author once did during Marine maneuvers...

LAST evening, during a take-off at LaGuardia Field, I was about 50 feet off the ground in a DC-3 when the plane gave a sickening wobble and the left wing dropped about 30°. Since we showed an indicated air speed of about 135 m.p.h., the wing was returned without too much effort, but the lesson received was sufficient to remind me of an instructive lesson received long ago in the Marine Corps—and which I had apparently forgotten momentarily during the bustle of LaGuardia's evening traffic. . . .

I had taken off directly after a Douglas of Eastern Air Lines, with but a 50-second interval between departures—and I had forgotten about his slipstream which still caused turbulent air along the runway, though the Eastern ship was well away from the field.

As is the habit of most pilots, I think, one goes back over the day's flying sometimes before falling asleep that night, particularly if something unusual has occurred during the day. This little tussle with a slipstream recalled in retrospect what I'd seen another slipstream do to other planes and pilots in 1931.

At the Cleveland Air Races of that year I was flying Number 3 position in an exhibition-acrobatic fighter squadron of the U.S. Marine Corps, then commanded by Lieut. Lawson H.M. ("Sandy") Sanderson, one of the finest fighter pilots the Marine Corps ever listed. It was the second day of the meet and we were supplying some of the Roman Holiday thrills for the well-filled grandstands. (I always think of the "Roman Holiday" aspect of these events, since attendance always was directly proportionate to the number of crackups.)

We had taken off on schedule in about the middle of the afternoon and were putting on our show, which consisted of a series of formation-acrobatic maneuvers and included formation loops-in-vee, loops-in-line, a loop of a squadron line which became a squadron line reversement using a snap-roll in formation at the top of the second loop, still retaining line formation. Our finale was a squadron "squirrel cage," with all nine ships in a continuous tail-chasing loop. We were using Curtiss *Sea Hawks* (Navy F7C's) and they were a good plane for the job, having plenty of power (for their day) and light wing loading.

Brice (left) and Sanderson after jumping.

The way we "went into" this finale squirrel cage was something to write home to Mom about: we formed a line to the right of the squadron leader's ship, then slid under one another into a nine-plane stack (layer cake fashion in a single vertical plane) with a 20-foot vertical interval between ships. This formation was held by each pilot looking up, with head against the head-fairing behind the cockpit and holding his ship precisely under the ship directly above. The entire formation was then dived, gently at first, but increasing in dive speed until the stacked ships were doing about 200 m.p.h. at which time the squadron leader, who flew Number 1 at the top of the stack, would peel off and upward into the sky in a wide, easy loop—each succeeding plane following him off the top in similar fashion at proper timing interval. It was a beautiful thing to watch as the cage was completed with all nine planes spaced perfectly around a single loop. This formation was then held for a few minutes and then the flight would be dived down and landed in vee-of-vees formation. . . .

On this particular day we had a strong

(*Continued on page 84*)

Two "stamp flyers" get a few pointers from an instructor before their flight.

ROBINSON

FLYING STAMPS

by EDWARD CLARKE

Stick enough of them in enough books and you can fly free—in Grand Rapids and Cleveland, at least. The idea came from Sam Fletcher, an enterprising merchant.

THE legendary Thief of Bagdad, who flew through the air with the greatest of ease on a magic carpet, didn't have anything on thousands of air-minded Americans all over the country who are flying on stamps. This sounds like a rather broad statement but it has been made a fact by the Flying League of America, an organization whose flying stamps, received with purchases, can be exchanged for free flying lessons.

All you do is save the stamps in a book until you have 600 of them. Then you present them to any accredited flying school connected with the League in exchange for 10 minutes of free flight instructions.

The Flying League of America is a non-profit organization designed to stimulate civilian interest in aviation and at the same time make it possible for men, women, boys and girls to get actual expert flying instructions without cost or medical examination. The League was formed in June of this year by a group of civic and business leaders in Grand Rapids, Mich. From rather small beginnings, the idea has never ceased to gain momentum. To date it has spread over 10 states and was expected to have moved across the whole country before the year was out. It is no wonder that the idea is so popular because it is a natural business stimulant for merchants and at the same time is a practical means for any able-bodied flying fan to learn to pilot a plane.

Organization of the plan is simple. Here's how it works. Local merchants sponsor the whole thing. Each merchant buys the stamps in blocks of 5,000 for $15 a block and gives them away with purchases. They are giving from four to 10 stamps with each dollar's worth of merchandise purchased, depending on what type it is. This means that you must buy from $60 to $150 worth of merchandise for each 10 minutes in the air.

This figure isn't high when you stop to think how much money the average family spends in a month. There are always enough varied types of stores so that you can make almost all your pur-

These stamps are a common sight in Cleveland and Grand Rapids stores.

ROBINSON

Sam Fletcher, originator of the idea, is a Grand Rapids haberdasher and airman.

chases from a Flying League merchant and thus have it apply toward your flying instructions.

The purchaser saves the stamps until he has the required 600 and presents them to an affiliated flying school for 10 minutes' dual instruction. An appropriate book has been designed to keep the stamps in and is given free of charge. Funds received from the sale of the stamps are put in escrow for a period of two years. Since the organization is run on a non-profit basis, only enough money is retained from these funds to carry on the necessary advertising. If, at the end of two years, there is any money left in escrow, it will be used in general aviation publicity. The money in escrow is paid out to the participating air schools as the books are turned in.

The whole thing began, strangely enough, in a Grand Rapids men's clothing store. Sam Fletcher, a haberdasher and sportsman pilot, was trying to sell a suit to an air-minded gentleman who protested that he couldn't afford one because he was spending all his surplus funds on flying lessons. Fletcher, in a joking way, offered to pay for a lesson if the man would buy a suit and was surprised to be taken up on the offer. He stood by his statement and paid for the flying lesson.

Word got around town that he was giving free flying lessons with purchases. Other merchants heard the rumors and the idea sounded good to them. Rather than "fite 'im," they thought it would be wiser to "jine 'im," so they suggested to Fletcher that he form a merchant's organization to carry out the plan on a larger scale. He was elected president and the Flying League of America has been growing by leaps and bounds.

The idea proved popular in Grand Rapids. It is estimated that 300,000 people are saving stamps there now. At first, only 19 merchants subscribed to the plan. But people began asking for the stamps so frequently that, inside of three months, 290 other merchants had become affiliated. Up to the present over 2,000 air-minded Grand Rapids citizens have had Flying League dual instruction at the two flying services connected with the organization.

You can be sure that you will get bona fide lessons for your stamps. Only Government-licensed air schools are affiliated with the league. The Government grants licenses only after careful examination of pilots and equipment according to strict regulations laid down by the Civil Aeronautics Authority. The League does not select any school or group of schools to participate in the plan. Licensed flying schools near the town where a chapter is located are asked to join. In Cleveland, stamp savers can redeem their stamps for flying lessons at any one of eight flying schools located at the five nearby airports.

The instructions you receive are exactly the same as those given in regulation flying lessons. You can take as many dual flights as you wish as long as you have a book of stamps for every 10 minutes in the air. However, you can't solo. All time in the air must be in the company of an instructor. Anyone between the ages of 16 and 65 who is physically fit can participate in the program.

It shouldn't take anyone long to save the 600 stamps. Contrary to the usual procedure in stamps-for-merchandise plans of this type, the Flying Stamps are transferable. This means that you can get your family, friends, relatives, church group, Scout troop or classmates to save them for you.

This has resulted in something similar to a mad, perpetual scramble among some families in those cities having the plan. The furor is attracting so much attention in some circles that queries have been sent in by merchants in other progressive communities. We do not know the plans of the Flying League of America as regards other communities, but it is quite possible that the idea soon will be widespread enough to have representation in all sections of the country. Several midwestern and western cities have expressed especial interest.

The Cleveland chapter has been launched by Humphrey, Prentke and Associates, an advertising firm which has handled publicity for the National Air Races for a number of years. The program has been under way there for a little over a month and, in that short time, the stamps have been made available to the public through more than 5,600 outlets. These include a drug store chain, a grocery chain, a department store, auto dealers and many others.

Many prominent men in business and aviation circles have their interest in the scheme. Among these are J. H. DuBuque of the Civil Aeronautics Authority; Prentice Brown, Michigan State Senator; Thomas E. Walsh, manager of the Grand Rapids airport and Maj. Jack Berry, manager of the Cleveland airport.

END

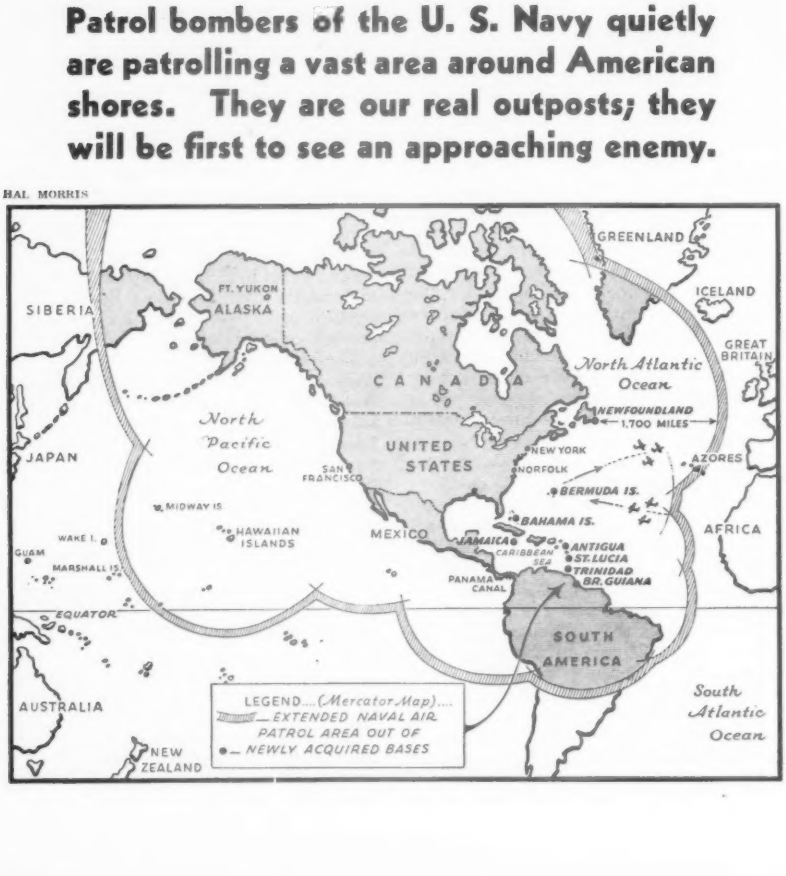
ON GUARD!

This PBY was photographed during a recent patrol mission along the Alaskan coast.

by HAROLD KEEN

Patrol bombers of the U. S. Navy quietly are patrolling a vast area around American shores. They are our real outposts; they will be first to see an approaching enemy.

HAL MORRIS



Based conservatively on a 1,700-mile radius, map shows area patrollable by PBY's.

IF the United States Navy is not getting an eagle's eye view of much of the world worth scanning, it is only because the niceties of neutrality force it to hug its own shores. For the fleet has an air force with telescopic vision that can cover with one sweep some 75,000,000 square miles of the globe, a huge portion of the earth's habitable surface and the sealanes approaching it.

In terms of national defense, this means that no hostile force, even from a great distance, could pounce on an unaware U. S. fleet, that no enemy could make the elaborate preparations required for an assault on our farthest outposts without being detected. Standing guard today in monotonous neutrality patrol—a prelude perhaps to grimmer duty—are some 225 of the internationally famed and respected PBY's, twin-engined, triple-duty, flying boat bombers.

We may not have a Navy powerful enough to defend us on both oceans, but we have a scouting air armada so wisely divided among all our vital defense centers that a foreign power will find full dress attack on any portion of the Western Hemisphere no child's play. Long before World War II frightened us into a supreme preparedness effort the indispensable character of long range patrol bombers was realized. Last January, only a month after Consolidated Aircraft Corporation had received a $20,000,000 order for ap-

proximately 200 more PBY's, virtually doubling the Navy's heavy scouting arm, Admiral Harold R. Stark, Chief of Naval Operations, disclosed plans to procure still 200 more of these craft.

Distance—how to cover it adequately and speedily—is more a factor in the defense of the United States than in any other first-rate world power. While Europe's airmen speak in terms of hundreds of miles—far less in many instances—required to reach their military objectives, this country, with its 3,000-mile breath, its far-flung possessions in many seas and climes, conceives its problem of protection in thousands of miles. The United States must defend Hawaii, the Aleutian Islands, Alaska, Puerto Rico, the Canal Zone and Guantanamo Bay, Cuba, to prevent a springboard attack on its own vitals.

To help thwart an aggressor far from our outermost ramparts is the job of the PBY's today. Just how much faith the Navy places in the long range patrol bomber is contained in Admiral Stark's revelation that some 600 of this type may one day in the not too distant future be deployed over the vital sea gateways we must dominate to live. The core of this coming sky fleet, the 225 bombers in squadrons scattered from Coco Solo to Sitka, from San Juan, Puerto Rico, to Cavite, Philippine Islands, has been on the job many months—quietly and efficiently. The exact areas covered by ceaseless neutrality patrols has been an official secret since their inauguration with the declaration by President Roosevelt last year of a limited national emergency. But easy to conjecture are the possibilities of their employment when and if the "limited" is blotted out and we stand face to face with a full-fledged national emergency.

PBY squadrons today are located at San Diego, Seattle, Sitka, Pearl Harbor, Cavite, Coco Solo, San Juan and Norfolk. Other bases will be prepared for them as the number of bombers increases. Besides established bases the PBY's tough characteristics enable them to operate from refuelling ships far at sea, from coastal points without benefit of a harbor's protection and even from inland lakes and rivers. Excluding the latter contingencies, the PBY's scope from present stations where crews are receiving intensified training, remains staggering. The shadows of these graceful flying boats can fall over Burma or near the North Pole, over Bolivia or the Phoenix Islands, over Greenland or Australia if the occasion ever arises.

In ideal weather a PBY can travel almost 2,000 miles from its base before traveling back. This, of course, does not take into account inevitable detours during reconnaissance. However, the 2,000-mile radius may be considered a not unreasonable maximum one-way range for purposes of determining the extent to which the Navy's patrol fleet can blanket distant areas. Flying boats of the near future—the Consolidated experimental Model 31, for example, which has a reputed non-stop range of approximately 10,000 miles—will make the 2,000 mile figure seem puny indeed.

Equipped with sufficient bombers to permit maintenance of full strength at each of today's PBY bases, where could the Navy extend prying eyes in war? The vast stretches of Pacific in the now familiar defense triangle with Alaska as its peak and Hawaii and San Diego as the termini of its base would be completely under surveillance by patrol squadrons stationed at San Diego, Pearl Harbor, Seattle, Sitka and Kodiak.

ACME

These PBY's of VP-12 (Patrol Squadron 12) are based at San Diego, can carry out non-stop missions from there to Canada, into Latin America or close to Hawaii and return.

Many strategists consider still more important as a defense zone the area west and possibly south of Hawaii. This island fortress is the padlock to Uncle Sam's barn door. The brigand who breaks that lock will make a serious breach in the defense of the adjoining residence—the United States itself. Seizure of Hawaii can be effected only through shattering the backbone of our powerful fleet. Today five to six dozen PBY's are stationed at Pearl Harbor, a force which undoubtedly would be augmented greatly in a Pacific emergency. These craft can patrol to within a short distance of Wake Island west of Hawaii, southeast to Canton Island and well towards Samoa in the South Pacific where the American naval station of Tutuila is located.

At the islands of Wake and Midway, the halfway stop-over on a flight from Hawaii to Wake, are adequate seaplane anchorages. Their admirable location will allow more extended periods at sea away from the main base at Pearl Harbor and will give the fleet sustained patrolling capacity in naval action west of Hawaii. Lying beyond Wake and another convenient halfway stepping stone, in this instance to the Philippines, is Guam whose proposed development as a major base has been viewed with almost belligerent suspicion by Japan. There is little doubt that Guam will be fully equipped with long range patrol planes should circumstances force the Navy to stage a large scale campaign in the western Pacific. From Guam, waves of PBY's can be unleashed west beyond the Philippine archipelago into the China Sea and south actually into the Australian continent where it points a finger of land toward New Guinea. And in a southeasterly direction the Caroline and Marshall Islands would fall easily within their aerial sweep.

With little fanfare following mass flights from Hawaii which demonstrated the effective mobility of large PBY squadrons, Cavite recently has become an official PBY

(*Continued on page* 70)

"FLIGHT 14"

The flight dispatcher (top) watches the progress of every flight. Flight 14 (above) prepares to leave.

by MacDonald Hays

What actually goes on "up front" in a big transport? This airline pilot, a former Army pilot who wrote "Cadet Days at Randolph Field," takes you with him

MacDonald Hays

THE place: the Kansas City airport terminal. The time: any day at 2 p.m.

"Attention please: First call TWA, Flight 14. East-bound for St. Louis, Indianapolis, Columbus, Dayton, Pittsburgh and New York. All aboard, please. Give your name to the hostess as you board the plane."

The Kansas City passenger agent lays down his microphone. Passengers file out of the terminal building and enter the plane. The captain gets the "all clear" signal from the ground, they taxi out and take off. As simple as that.

But let's look behind the scenes at the preparation necessary for Flight 14 then board the plane and ride to St. Louis (the first leg of their trip) in the cockpit behind the captain and first officer.

First of all let's follow the captain and first officer after they arrive at 1 p.m. on the field—which is one hour previous to take-off time. The captain goes immediately to the meteorology department to check ceiling, visibility and air temperature along the route. The chief meteorologist enters with the latest weather observations, which are made every hour along the route and a forecast sheet covering the next four-hour period.

"Captain Smith," he says, "You will have turbulence below 5,000 feet to Indianapolis with high scattered clouds above 10,000 and lower broken clouds at 8,000. I recommend 7,000 feet as the best altitude. From Indianapolis to Pittsburgh you will encounter a cold front at Columbus (he indicates a blue line on the air mass analysis chart), with lowered visibility. Your best altitude from there on in to Pittsburgh is 5,000 feet."

Captain Smith checks the previous weather map to discover which way the bad weather is moving. He hands the weather sheet to his First Officer. "Here,

Jones," he says, "make out the flight plan for 7-7-5-5-5."

Jones, a tall, alert-looking chap translates this to mean climb and cruise at 7,000 feet to St. Louis, 7,000 to Indianapolis, then 5,000 Indianapolis to Dayton and Columbus to Pittsburgh. Jones walks to a shelf outside the operations office and selects a sheet on the top of which is written "Flight Plan." He writes the courses and distances between points on the route, direction and speed of the winds aloft at 7,000 and 5,000 feet, with temperatures at that altitude, then with his calculator figures what loss or gain of ground speed the wind will give at their chosen altitudes.

TWA captains and first officers are equipped with engine and performance charts made by the Wright engineering laboratory and TWA engineers. For example the True Air speed vs. Horsepower vs. Temperature Chart gives 1,200 hp. necessary at 7,000 feet to make a true air speed of 184 mph., with outside air temperature at 40°. Winter schedule time between Kansas City and St. Louis is one hour and twenty-four minutes.

Jones figures from the meteorology sheet containing the wind velocity and direction at 7,000 feet that they will have a tailwind of 10 mph., which will make their ground speed 194 mph. and should put Flight 14 in St. Louis three minutes ahead of schedule.

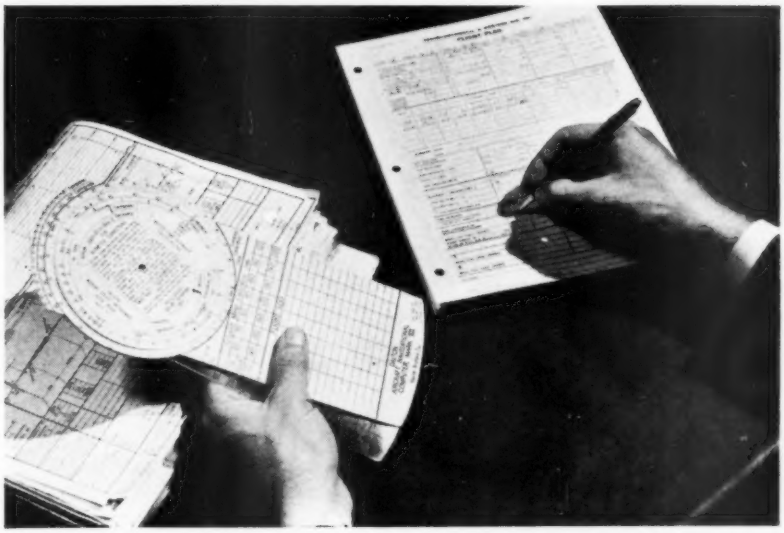
He finishes his flight plan—on which is given the horsepower, estimated ground speed and gasoline consumption per hour for all legs on the flight through to Pittsburgh.

Next in the sequence-before-flight is the making of an Airways Traffic Control form on which Jones writes the approximate time Flight 14 will be over Higgensville, Columbia, New Florence, Weldon Springs and St. Louis—the check points over which radio reports are given. If the winds aloft are correct this forecast check point time is accurate to within two or three minutes.

Jones gives the ATC form to a radio operator who puts it on the teletype as an aid in coordinating this time with that of other airplanes in the same vicinity (called traffic). Captain Smith and the flight superintendent check and sign Jones' work and now we're ready to depart.

At this point I can hear some of you saying, "So what? What good is a flight plan—or an ATC if the winds aloft change so that more or less power is required to maintain a schedule?"

Well, the winds *do* change. But here's the point. The flight plan gives the captain and first officer a good basis upon which they can figure and calculate while in the air. It's an added safety measure. For example: suppose Jones has figured on using 102 gallons of gasoline per hour. That means they will use 143 gallons to St. Louis. Now it's a Civil Aeronautics Administration rule that airliners must land with at least 70 gallons of gasoline —or a 45 minute supply in the tanks, so 143 plus 70 equals 213 gallons, but to be on the safe side we carry 350 gallons and should land with 200 gallons of gasoline remaining—enough to take us anywhere within a 400 mile radius.



Every part of the airliner's trip is calculated carefully before the ship leaves the airport. Calculations are entered on a flight plan which must be adhered to.

It's 10 minutes before schedule take-off time at 2 p.m., so Smith and Jones walk to the airplane. You enter the ship behind Smith and Jones and walk up to the cockpit. You can stand up now and watch Jones go through his regular before-take-off routine. He picks up a check sheet titled "Before starting engines" and calls out: "Battery cart on—gasoline checked, radio checked. . . ." He and Captain Smith check each item.

He picks up his mike, "Flight 14 to Kansas City. Radio check." TWA's radio operator returns: "Kansas City to 14. Transmission normal, time 57, five seven (minutes past the hour), altimeter 29.80, two nine eight zero."

Passengers and baggage are already on the ship, and Captain Smith gets the "all clear to start engines" signal from the ground. He starts the right engine, then the left. Jones shifts the electrical load from battery cart to airplane battery. Okay—let's go—but no; first Captain Smith gets a salute from the passenger agent which means "all clear to taxi."

Jones changes radio frequency to the control tower frequency and presses his mike button: "TWA Flight 14 to Kansas City tower. Ready to taxi out."

The tower operator returns, "Okay to taxi out TWA 14. Wind north-west three, NW 3, traffic taking off north. Your clearance: Flight 14 is cleared from Kansas City to St. Louis tower to cruise 7,000, cross Weldon Springs 2,500, no essential traffic reported."

Jones repeats the clearance as the plane stops at the south end of the north south runway for the routine engine run-up. Out comes the check list with items to be checked before take-off: "Flaps up, trim tabs set for take-off, seat-belt sign on, carburetor air cold. . . ."

Captain Smith sets the parking brake, runs each engine up to 30 inches of mercury, tests the mags—Jones presses his mike: "TWA Flight 14 ready to take-off," receives the tower's okay and we begin to roll.

You sit back in your "jump seat" and fasten the safety belt. The throttles go to the full forward position and as we leave the ground Captain Smith says: "Up gear." Jones unlocks the safety latch on the floor of the cockpit, pulls the landing gear lever to the up position and in the same motion picks up his mike: "TWA Flight 14 off at zero three and changing over."

The control tower repeats and Jones shifts to TWA company frequency and repeats our time off the ground. The company radio operator at Kansas City contacts St. Louis and gives our time off and also estimated total time to St. Louis.

Now we're 1,000 feet in the air heading on a course due east and Captain Smith pulls back the throttles to 30 inches of mercury and synchronizes the props at 1,900 rpm. We're climbing at 120 mph.

When we reach our cruising altitude at 7,000 you see Jones pull out his Wright power calculator. He figures a moment, glances at the outside air temperature indicator and says: "28 point 3 for 1,200 horsepower. Captain Smith moves the props to 1,850 and the throttles until the two manifold pressure gauges register 29 point 3. Now he moves the gas tank selector from the positive tank (left main) to the left auxiliary tank and glancing at the gasoline gauge we see that there is 85 gallons in this tank. The mains hold 210 gallons and each auxiliary holds a maximum of 201.

Well, now we can sit back and study our map for a moment. Straight ahead is a town with a small lake bordering on the east. Directly over the town the captain's thumb makes a sidewise movement —okay—we're over our first check point —Higgensville. Jones picks up his mike: "Flight 14 to Kansas City."

Kansas City replies: "Kansas City Flight 14. Go ahead." Jones makes his report using the standard procedure.

"Flight 14 over Higgensville at 24, two four, 7,000 contact (able to see the ground), estimate New Florence at 45, four five, temperature 35 . . . Jones." Kansas City repeats the report.

The line's meteorologists supply the captain and first officer with the latest hourly weather observations along the route. Thus the crew know precisely what's ahead.

Captain Smith and Jones seem to be busy every minute checking oil pressure, moving a lever to increase oil temperature to 150° or checking air temperature in the passenger cabin.

"Jones," says Captain Smith, "You'd better let down a quart of water. I see the steam pressure in our boiler is dropping."

Jones leaves his seat, lets down the required amount of water and notes a steady rise in steam pressure up to 25 pounds. When you ask about the heating system Captain Smith explains that the passenger cabin is heated by a water jacket surrounding the engine exhausts and that steam generated by a quart to three pints of water is generally sufficient for an hour and a half flight. A gauge over the co-pilot's seat shows the exact temperature in the passenger compartment at all times. Air entering the nose valve of the ship is heated to 70° and passes into the passenger cabin.

Captain Smith glances at the ground, then wags his thumb. We're over New Florence and Jones contacts St. Louis.

"Flight 14 over New Florence at 44, four four, 7,000 contact, estimate Weldon Springs at 10, one zero, St. Louis at 21, two one, temperature 33, gain 22 . . . Jones."

Our speed is slightly more than Jones had estimated since we've picked up a tail wind of 22 mph. You settle back thinking that's all the work necessary before our arrival at St. Louis. But not Jones. He reaches behind his seat and pulls out the airplane log—Form 76.

This log gives a complete record as to functioning of engines and airplane for each leg of a journey. Over his shoulder as he writes we see:

Engines—ignition—radio—oil pressure and temperature . . . normal. Altitude —7,000, air speed—175 mph., horsepower —1,200, fuel per hour, 90 gallons.

Jones replaces the log. When we reach St. Louis he will enter our total time between Kansas City and St. Louis, and the ground crew will enter the number of gallons of gasoline and oil with which they service the ship.

Jones makes his report over Weldon Springs, then when we're five minutes from St. Louis, picks up his mike and says: "Flight 14 to St. Louis. Over The River and changing over."

"Okay to change over. Altimeter 29 point 94, two nine nine four."

Now we leave the TWA radio frequency and contact the St. Louis tower on 278 kc.

"TWA Flight 14 to St. Louis tower, over The River, go ahead."

"St. Louis tower to TWA Flight 14. Okay, over The River, the wind west nine, runway number one, local traffic. You are cleared to the field."

Smith and Jones keep a sharp watch on two small yellow *Cubs* circling the field. Jones gets out his "Before-landing" check list. . . . "Gas on left main, full rich, props 1,850, tail-wheel locked." Captain Smith checks each item and then slows the ship to 150 mph. "Down gear."

Jones pushes down the lever which lowers the landing gear and, when the landing gear strut pressure reaches 750 pounds, locks the safety latch and repeats: "Gear down and locked, pressure 750 pounds, green light on."

We swing to the east of the airport, descend to 1,200 feet, line up with the east-west runway and slow to 110 mph.

"Down flaps three quarters," says the captain.

Jones lowers the flaps, returns the flap lever to neutral. "Flaps are down three quarters."

We touch the ground. Captain Smith pulls back the control column says: "Up flaps"—then pushes the propeller controls ahead to full low pitch, returns the elevator trim tab to neutral, unlocks the tail wheel and we taxi slowly to gate No. 3 where a mechanic in white coveralls stands with hands over head.

Jones presses his mike button, changes to TWA radio frequency: "Flight 14 on the ground St. Louis at 24, two four."

The figure in white below us extends his arms horizontally—we come to a stop. Jones pushes the carburetor controls to the "full lean" position, Captain Smith reaches overhead, cuts the ignition switches and sets the parking brake.

As you leave the ship you see Smith and Jones head for a telephone in the operations building where they will give their estimated time and altitude on the next leg of the flight—to Indianapolis.

Well, you think, it's not a simple thing to fly an airliner, yet even on this short flight you have been able to observe the logical steps in preparing for a flight, the flight itself and see a little of the organization behind Flight 14.

Smith and Jones wave to you as they pass on the way back to their ship. The first leg of a routine flight has been completed and the last thing you hear as you leave the terminal building to search for a taxi is: "Last call for TWA Flight 14, eastbound for Indianapolis, Dayton, Columbus. . . ."

END

Nylon in the Air Corps

THERE is very little about Nylon that research engineers of the Army Air Corps haven't known for some time. Three years ago the Army's Material Division at Wright Field began tests to determine whether or not Nylon would be a suitable substitute for silk for parachutes. Comparative tests of Nylon vs. Silk were made, including tests of the physical properties of the two fabrics, exposure to weather, ultra-violet and infrared lights and immersion in various acid and alkaline solutions.

It was found that ultra-violet rays weakened some types of Nylon more than silk, but in 20 days of continuous exposure to weather (including snow, rain and sunshine) the tensile strength of Nylon decreased only one-tenth, while silk decreased one-third. Exposure to 170 hours of strong sunlight resulted in silk losing 61 per cent of its tensile strength; Nylon lost 67 per cent but, since its original tensile strength was considerably greater than silk, Nylon was stronger than silk at the end of the test. The synthetic fabric also retained more of its elasticity than silk. Nylon also was found to be practically unaffected by mineral acids and alkalis, though silk was soluble in strong alkaline solutions.

Two complete parachutes with Nylon canopies were made. With dummies of varying weights attached, both Nylon and silk parachutes were dropped from an airplane flying at prescribed speeds to obtain various shock-loadings of the canopies. These tests proved Nylon to be as good as silk. A Nylon thread and webbing also have been developed that are suitable substitutes for the linen thread and webbing now being used in parachute harnesses.

Service Deluxe!

IF you plan to fly to Australia, take your fishing rod. For, when the big British flying boats land on Australia's Gulf of Carpentaria to refuel at the Princess Elizabeth lagoon, passengers are invited to enjoy an hour's fishing from the plane. They always are able to supply the plane's steward with parrot fish, rock cod and mullet for their scheduled dinner at Darwin.

The STALL and the TURN

by J. F. GUILMARTIN

Pilots who insist on arguing over the characteristics of stalls and turns will want to fortify themselves with some facts on this highly academic controversy.

FROM the ranks of the 50,000 to 60,000 pilots that are being trained each year, we know you will find at least 75,000 vociferous exponents of the art of hangar flying. The so-called "vertical" bank and the advanced stall will possibly bring about as many debates as has the downwind turn. You probably are better equipped than anyone else at the airport to uphold your end of the argument but, just in case, here is a little more ammunition for you to use.

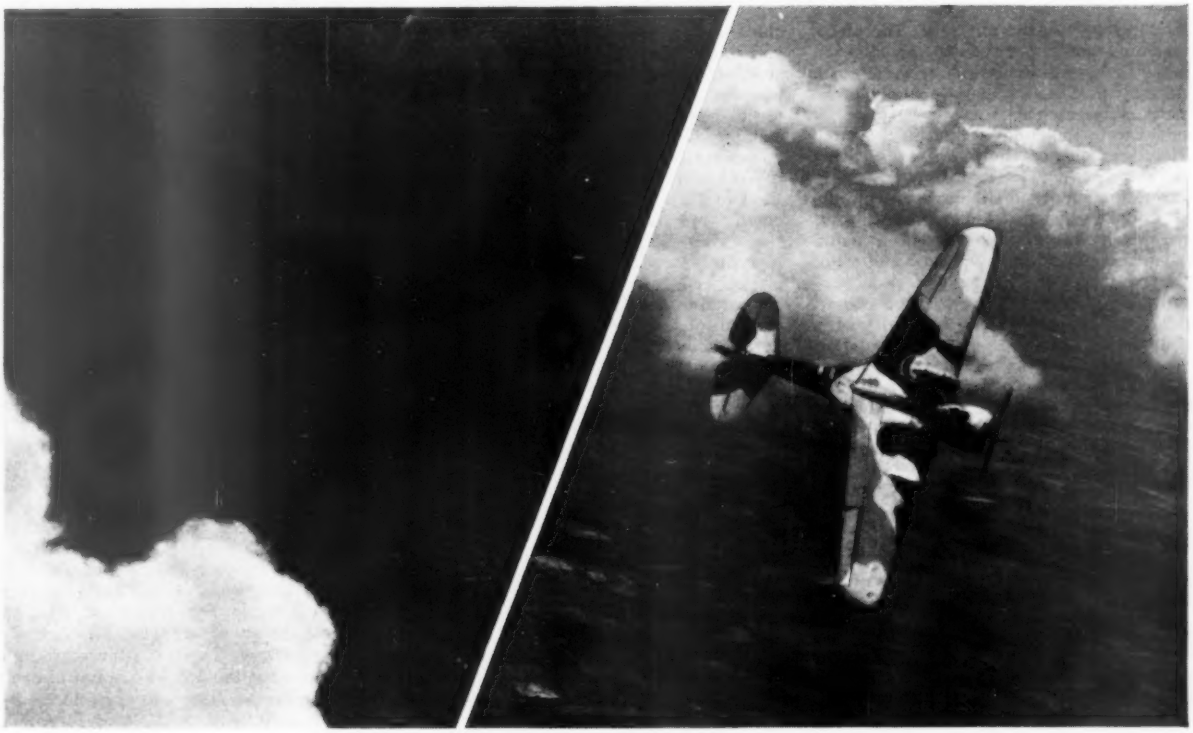
At the time you were given your oral examination for instructor rerating, you answered and possibly asked numerous questions regarding turns and stalls. Each new student very likely confronts you with some new angle of explanation or demonstration of turns and stalls that was not covered at the time of your rerating. Further, it has not been possible, to date, for you to obtain specific information on turns and stalls in current publications. While it is appreciated that it is impossible in one short article to answer all questions that may arise on these maneuvers, the following information will aid you in presenting, in a logical and standardized manner, their fundamentals.

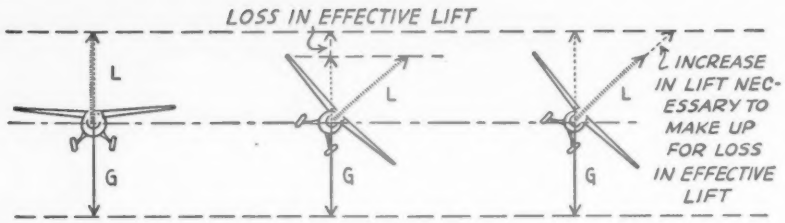
As we well know, it is of prime importance that we be able to change the direction of an aircraft in flight at will. Hence, the turn. This, perhaps the basic flight maneuver, will be discussed first.

We have, in general, three kinds of turns. We will speak of a *turn* as a maneuver in which a change of direction is accomplished without gain or loss of altitude. A *climbing turn* is a maneuver in which a change of direction is accomplished with a gain of altitude. A *gliding turn* is a maneuver in which a change of direction is accomplished with a loss of altitude. We must also agree that, in a properly executed turn of any kind, the ship is not allowed to skid and, once the desired bank is attained, this bank is held constant.

We do not mean to imply, however, that maintaining an exactly constant degree of bank is absolutely necessary, or even particularly desirable, during elementary turn instruction. It is first necessary for the student to be able to recognize the overbanking tendency before he can cor-

In most modern aircraft, like the Beechcraft (left), the pilot gets ample warning through "buffeting" to avoid the serious stall. The Army P-36A (right) is illustrating an almost perfect 90° vertical turn.





This diagram illustrates the author's discussion of the effect of turns on an aircraft. Note the drop to be expected whenever a plane is banked without climbing.

rect it—and this he will probably not be able to do until he has attained considerable familiarity with the mechanics of the turn. (Ofttimes the student first notices the overbanking tendency during instruction and practice in *climbing turns.*)

Turns may be classified as gentle, medium and steep although, at present, some confusion is attendant to this classification. The accomplished pilot does not think, when he wants to change direction, "Will I use a gentle or a steep turn?", but merely applies the pressures necessary to cause his aircraft to follow the desired flight path.

Elementary turn instruction is easier for the student to grasp if a bank of about 25° or 30° is used. Of course, it means nothing to tell the student to do a 30° bank, but he must be shown the degree of bank desired, by means of a demonstration in flight, by the instructor. The student should be given, on the ground, a concise but clear conception of the directions that he should apply pressures to his controls to accomplish a proper turn. This explanation should be somewhat in the following manner:

"To turn the airplane, it is necessary to bank it, otherwise we will skid. To bank the ship we use the ailerons. Therefore, we must apply pressure to the stick or wheel in the direction we wish to turn. As may be noted, when we apply pressure to the stick it is necessary to apply pressure to the rudder pedal in the same direction; i. e., on the same side, to *keep the ship from yawing* and slipping. (More about this later.) The pressure on the stick and rudder pedal is maintained until we reach the desired degree of bank. Then the aileron is neutralized and *all* of the pressure on the rudder pedal removed. The instructor will, of course, demonstrate the degree of bank he wishes the student to attain for his *turn* practice. The student will have to learn by practice the proper proportion of pressures necessary to attain and recover from his desired bank without skids or slips. If we wish to maintain our altitude in the *turn,* it will also be necessary to apply pressure to the rear on the stick or wheel as we bank the airplane, because of the loss of *effective* lift. (The student will find it necessary to use visual references in order to estimate the amount of back pressure necessary. Common practice is to tell the student to use as much back pressure as is necessary to 'keep the nose on the horizon.' Side-by-side ships, of course, have somewhat different references for right and left banks.)"

After the turn has been explained to the student somewhat as above, and any questions he might have are answered, a demonstration of the maneuver by the instructor is in order. This, of course, must be started from straight and level flight. There are two things that the student may learn from this demonstration. He may see what the attitude of the aircraft is when it is in a proper *turn.* And, if the instructor uses his controls *positively and smoothly,* he will be again impressed with the *direction* that it is necessary to apply the pressures on the controls. He will *not* be able to form any idea of the *pressures* necessary until he attempts the maneuver himself. Any "help" from the instructor, in the form of pressures by the instructor on the controls, when the student is attempting a turn, will destroy the possibility of the student determining the amount of pressures necessary to accomplish the desired maneuver. (Caution: During demonstrations to the student do not confuse *slowness* in application of pressures with *smoothness.* Also remember that we cannot "teach" the student to fly. He must learn for himself. However, we can help him a great deal with his learning process.)

Now, in order for the instructor to intelligently answer any questions that the student may have with regard to turns—and to enable the instructor to give the student the maximum amount of help in his efforts—it is necessary for the instructor to have a clear and detailed understanding of all the factors involved in the maneuver from a practical standpoint.

We know that there is no reversal of the functions of the controls, but do we clearly understand just what these functions are? Taking the control surfaces separately, we shall analyze their actions and effects.

First the elevators. Regardless of the position of the aircraft, the elevators can do but one thing. This is to change the angle of attack. As long as we have flying speed this means, practically, that we obtain more or less lift from our wings by the use of the elevators. This may also be done by varying the speed through the air. Remember that the lift on the wings acts at right angles to the span, or lateral axis.

Secondly, the ailerons. Regardless of the position of the aircraft, the ailerons can do but one thing. This is to give one wing more lift (by increasing the angle of incidence) and, at the same time, to give the other wing less lift. This, of course, causes the aircraft to bank. Unfortunately, however, when the ailerons are used, one wing is not only given more lift than the other, but is also given more drag (induced). That is, the wing on which the aileron is depressed tends to drag behind the other wing.

Thirdly, the rudder. Regardless of the position of the aircraft, the rudder can do but one thing. This is to control the yaw of the aircraft. Using the rudder can either make the aircraft skid or slip, or as we normally use it, keep the airplane from slipping or skidding.

Now let us consider just how and why we use the controls as we do in order to turn the ship properly. We must use the ailerons and bank the ship, otherwise it will skid because of centrifugal force. However, when we use the ailerons the outside wing will tend to drag behind the inner wing, this causing the ship to slip (skid toward the low wing). We must use the rudder to correct this tendency to slip. That is, we must use the rudder in the same direction as the pressure is applied to the aileron control. The rudder does not *turn* the aircraft properly, in flight, nor does it "start the turn," but it only keeps the aircraft from yawing as we assume our new attitude. If we use the ailerons and rudder together and in the proper proportion, our plane will now be in a bank and it will have entered it without slips or skids. However, if we plan to make a *turn,* we will have to do something about the loss of *effective* lift.

Except for the negligible loss of speed caused by the use of our ailerons and rudder, our plane will have the same amount of speed after we roll into the bank as it had while we were flying straight and level. Therefore, since we have not changed the angle of attack as yet, it will be producing the same amount of lift. However, this lifting force will no longer be directly opposed to the force of gravity, but will be acting at some angle to the gravity force, depending upon our degree of bank. Therefore, in order to maintain altitude as we wish to do in our *turn,* it will be necessary to obtain *more lift* to do the same job of keeping us at our same altitude. This lift is normally obtained by use of the elevators to increase our angle of attack. Now as we know, when we apply pressure to the rear on our stick thereby increasing our angle of attack and obtaining more lift, we also increase our drag (induced), and unless we use more power, we reduce our air speed. It is *not* correct to say that in all turns (climbing and gliding included) speed and lift is lost, but it *is* correct to say that in order to obtain the amount of lift necessary to maintain or increase our altitude, we must sacrifice speed.

To properly execute a *turn* we must coordinate the use of our aileron, rudder and elevators and apply the pressures to them in the proper proportion. We may execute a fair *turn* without properly coordinating our elevators, but imagine a lazy eight attempted without coordination of all of the controls.

There is another fallacy prevalent at present, that we should clearly understand. This is the idea that we can "tighten the turn" with the elevators by pulling back on the stick. If we are in a *turn* and have the proper amount of back pressure on the stick necessary to main-

(*Continued on page* 76)

Want a Job?

by HURD BARRETT

FOR the record, we're going to summarize briefly and quote in part a pamphlet entitled "A Statement Regarding Aviation Training Schools and Employment in Aircraft Factories in Los Angeles County, California," which was published by the Los Angeles Chamber of Commerce under the date of March 28, 1940. We think it conveys some excellent reading for job seekers:

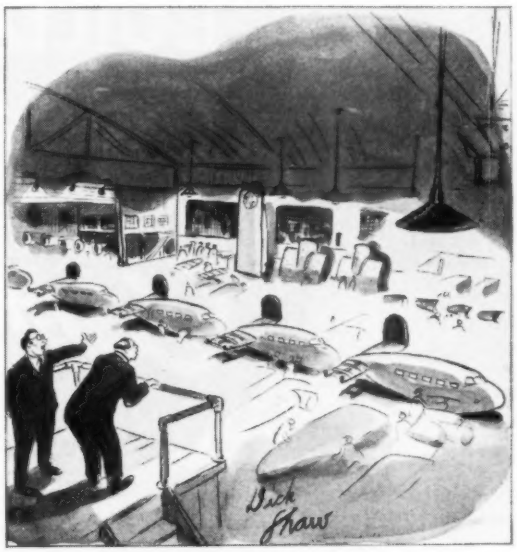
"In answer to thousands of inquiries . . . the Los Angeles Chamber of Commerce has made a comprehensive survey of the field (aircraft manufacturing). . . . During this survey the personnel heads of the five major manufacturers in this county were consulted. In arriving at conclusions, their statements were given major importance in the belief that the manufacturers . . . are in the best position to know the personnel requirements of the industry and the need for the aircraft training schools. . . . The following conclusions have been reached.

"1). . . . Differentiation must be made between vocational and job-training courses. A vocational training course is one requiring from a 10-month minimum to a four-year maximum for completion . . . provides training in a broad range of skills . . . in related technical subjects such as trade mathematics and drafting. The job-training course of from six weeks to three months duration is designed to teach . . . a single job such as riveting, welding or sheet metal assembly.

"2). The employee who has . . . a general vocational education is readily adaptable to many different jobs and . . . has a good expectancy for steady employment. . . . The job-trained employee is comparatively insecure, because brief . . . training equips him to do only one job and . . . he is not equipped (in the event of layoff) for transfer to another department.

"3). . . . No connection between the aircraft manufacturers and the private training schools (exists) . . . and (there is) no agreement either implied or stated that the manufacturers will employ their graduates. *Employment selections are made solely on the basis of merit, irrespective of the individual's former connections. In addition to mechanical knowledge and skill, there are usually other qualifications that are considered, such as personality traits, physical fitness, citizenship and, in some instances, the satisfactory passing of general intelligence, temperament, mechanical aptitude and other selective tests.*" (Italics ours.)

At this point let us interject a few remarks of our own. Among the many letters we have received have been several from persons who, with apparently excellent qualifications, have been unable to secure employment. If these individuals will carefully read the portion of this pamphlet that we have italicized above, they may understand just what their trouble has been. We do not wish to imply that all such persons are "personally, temperamentally or mentally unfit" for employment. In some instances, of course, this may be so; in others, geographical conditions may have been against them or they have hit the wrong person at the wrong time. Employment managers have their bad days too. Also—and we cannot stress this fact too strongly—most men looking for work are almost inevitably totally unable to sell themselves on the basis of their experience and qualifications. Somehow, when they secure an interview for employment, they become suddenly tongue-tied and a fog settles over their minds to the end that whoever is interviewing them has to struggle like the very devil to find out just what they can do. The symptoms seem to be rather like stage fright and the causes for them are about the same. Whatever the reason, the results can be disastrous to the job-hunter.



"Abercrombie, on Right Rudder, is home with a nasty head cold! . . ."

But to go on with the Los Angeles Chamber of Commerce's pamphlet—and we believe that the information it contains is so good that it will apply not only to aircraft manufacturers in Los Angeles County but to the whole field of employment in the industry—let's take its next paragraph.

"4). The employee who is trained as a skilled mechanic with several years of classroom and shop instruction has greater opportunity for advancement to . . . foreman's jobs than the job-trained employee. Promotions are, of course, dependent upon *other qualities of leadership.*

"5). The major aircraft manufacturers are unanimous in their opinion that there is no current need . . . for aviation schools of the job-training type. (As contrasted with *vocational* courses. Incidentally, we ourselves do not entirely agree, in view of the present demand for skilled riveters, sheet-metal workers, welders, aircraft electricians and other specialists. We do, however, refer you to paragraph No. 1 of the pamphlet which explains explicitly why men who are trained in several trades are more useful to the employer than those who can do only one thing.) . . . There is now an abundance of job-trained and semi-skilled workers in Southern California. (This, we believe, is fairly true, although it may not be true 90 days from now.) The manufacturers are emphatic in their warning that with the two exceptions of graduate engineers and skilled craftsmen there is an abundant local labor supply. . . .

"6). Some of the public schools offer adequate courses in mechanical training and it is suggested that those interested . . . should consult the vocational . . . departments of their local public school systems. The Civil Aeronautics Administration, Washington, D. C., issues a list of private schools to which it has issued letters of recognition indicating that their credits are acceptable for application toward a Civil Aeronautics Authority Airplane Mechanic's Certificate. It should be pointed out, however, that this CAA approval is given with primary reference to their capacity for training mechanics for the inspection, maintenance, overhaul or repair of aircraft, engines, propellers and appliances rather than for the actual manufacturing processes." (This is an important point and should be carefully noted by the job-seeker.)

With regard to the last paragraph, we might say that persons qualified for the inspection, maintenance, overhaul or repair of aircraft, engines, propellers and appliances should have little or no difficulty in obtaining employment with manufacturers, airline operators, or any other branch of the aircraft industry. As a matter of fact, persons who hold such certificates are so scarce that almost any employment manager in almost any

(*Continued on page 60*)

Closeup aerial views like this should sell on sight. The author made this with his homemade camera and a "Cub."

BUILD AN Aerial Camera

by **S. A. GRUGAN**

Photographs by the author

Many an amateur photographer-pilot would take aerial pictures if he had a suitable camera. Now he can build his own, easily and cheaply.

IF you are an amateur photographer and like to fly, an efficient camera for aerial work will double your enjoyment of both hobbies. The writer has experimented for some time with both the miniature and orthodox hand cameras in an effort to preserve those much enjoyed flights in the air. Both were woefully lacking in some manner or other. These disadvantages resulted in the construction of an inexpensive camera which produced pictures worthy of the time and expense entailed in its construction.

Construction

No measurements are given as these must necessarily conform to the camera selected for use. The first essential part necessary to begin construction is an old 4 x 5 spring-back view-camera. In our case, a second-hand Conley view camera was purchased for $3. Completely strip this camera of handle, rack and pinion, viewfinder, etc., retaining only the back portion and the bellows. Next build a frame of ½-inch white pine or preferably some hardwood, to fit snugly around the camera body (see photos Nos. 3 and 4) and screw it firmly in place. Note that the right-hand side is cut short to permit inserting and working a film pack adapter. Then again using ½-inch material, cut a front board with a suitable opening in the center to allow extending the bellows to fit this frame. Now set this aside for the time being and begin work on the front end of the camera which serves to protect the bellows from the plane's propeller blast. This consists of a tapered wood housing with the top so secured that it may readily be removed to permit attaching and removing the lens. To determine the length of this housing, measure the focal length of the lens and add about four inches. This extra length allows room for the lens board and serves admirably as a lens shade. Make this housing at least four inches square so that no trouble will be experienced in cocking the shutter and adjusting diaphragm stops while in the air. Nail the bottom and side pieces securely together and fin-

ish the top section to fit, but do not fasten it in place. The top is later screwed into place so that it may be removed to permit access to the camera's interior.

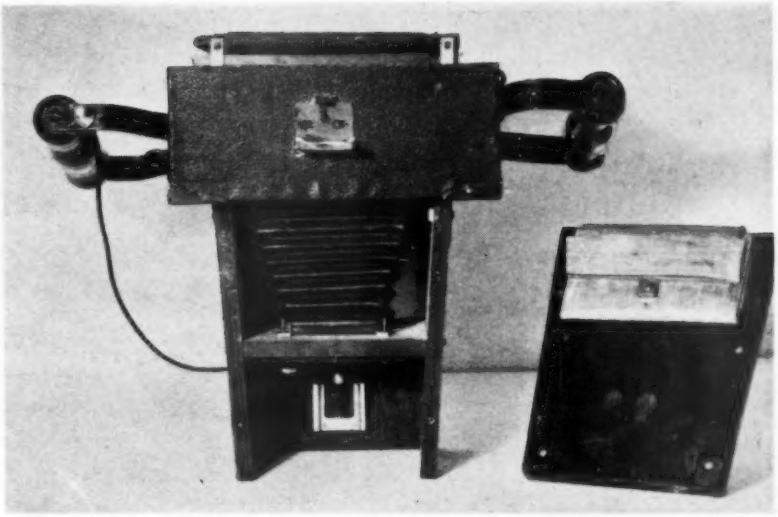
Secure ½ yard of imitation leather upholstering cloth and cover first the camera back, then the three-sided housing and finally the housing top. Use LePage's liquid glue and cover one panel at a time. This cloth is rather thin and the double thickness necessary at laps and corners will not be too bulky. With reasonable care a neat job will result and the leather-like finish of the material gives a decided professional appearance to the camera.

The next step is to secure two old electric iron handles. These are secured to each side of the camera body with suitable machine bolts. Place them at such an angle that the camera can be conveniently held for taking "oblique" shots as most of your pictures will be of this type. When drilling the camera body for these bolts, proceed with caution to avoid damaging the bellows. Use a lock washer under the nuts, as these bolts will be difficult to tighten after the camera is completed. Place box corners at the front of the camera to protect these joints and prevent the covering from working loose at this point.

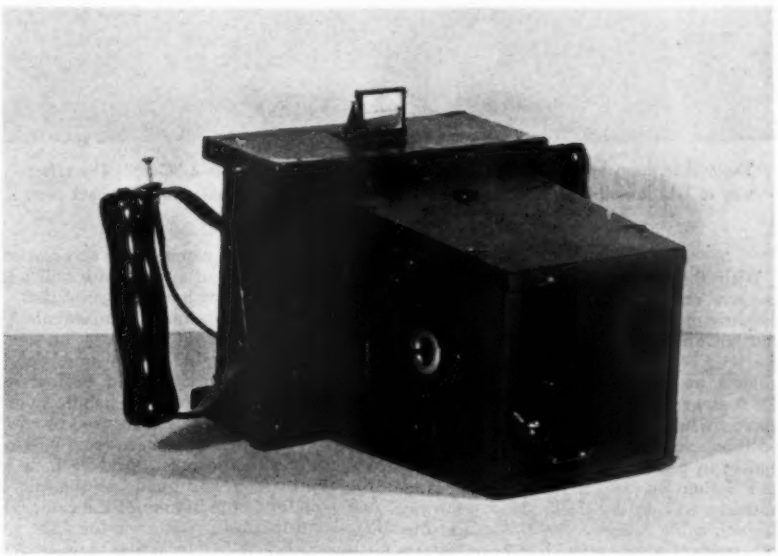
To secure the bellows housing to the camera body, cut four fastenings from light sheet metal and drill for small wood screws. Place three of them in position on the bellows housing and center the housing over the bellows opening. Then screw the housing firmly to the camera front board with ½-inch wood screws. Place the fourth metal fitting in place on the housing top.

To properly handle it in the air, we must add weight to our camera. After trying various weights we found that by bringing the weight up to eight pounds we could get good negatives, free from the fuzziness caused by the motor vibration or the prop blast. Obtain sufficient sheet lead from your plumber to bring your camera up to this weight. Cut this lead into strips and fold it to fit that space between the bellows and the housing top. Use a machine bolt and fasten it to the housing top.

The lens board now is cut out and fitted snugly in its approximate position in the bellows housing. Do not fasten this board permanently in place until you have properly focussed your camera, which procedure will be detailed later. Extend the bellows to this board and secure it with four counter-sunk screws, driven in from the front of the board. If you have a lens to be used exclusively with this camera, place it permanently in position on this lens board. If you plan using it also on your enlarger, mount it on a thin (⅛-inch) bakelite or wood auxiliary lens board. Mount this unit on the permanent lens board with four short stove bolts. Be sure to space these bolts far enough from the bellows, so that you can get at them from the rear of the lens board to place the nut on the bolt. The bellows track shown clearly in an accompanying photograph proved to be of no aid in focussing, but was left on because it improved the appearance of the camera.

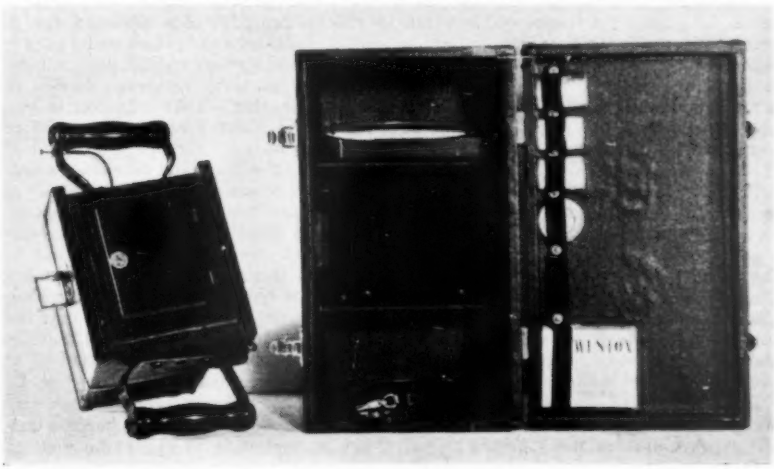


This is a top view of finished camera. Note sheet lead bolted to top panel (right).



The completed camera is a professional-looking job. Note angle of flatiron handles.

Below is the author's complete kit, including camera, case and required accessories.



The author shows how he handles his aerial camera when seated in a "Cub." The safest way to take low-altitude pictures is with another pilot flying the ship from the back seat.

Focusing

With the lens in position, place your camera on a solid support. Open the diaphragm to its largest opening; set the shutter on "time" position. Now force the lens board back or forward until all objects at a considerable distance, say 400 feet, are in sharp focus on the ground glass. When you are sure you have this position, screw the lens board permanently in place. Two screws, one at top and bottom on both sides of the bellows housing, will do the trick. Now secure a 12-inch cable release. Drill a hole in the grip support on the right-hand side—close to the grip so that you can reach it easily with your thumb—and large enough that the cable will pass through. A metal fitting held in place by the same bolt that holds the grip to the frame, will keep the release firmly in this position. Drill a hole in the bellows housing to permit attaching the release to the shutter. Glue a metal grommet in this hole to dress it up. Now fasten the already completed top in place with screws.

Miscellaneous Details

Buy a direct type view-finder to match your negative size and mount it directly in the center of the camera back. Attach a screw-eye to the upper front side and the lower rear side of the camera body. These are used to attach a neck-strap. The strap should enable you to carry the camera rather high on your chest, but should be long enough to permit tipping the camera up to make lens adjustments.

Paint all bright metal parts and exposed wood parts with black enamel.

A Case for the Camera

Once completed, you will want a carrying case for your camera and accessories. The construction of such a case will add but a few pleasant hours to your task.

First, to secure the measurements of your case stand your camera on end. Measure the height, width and depth while in this position. Add ¼ inch to the width (from handle to handle overall). This is purposely measured to close limits to prevent the camera from bouncing around in the case. Add ¾ inch to the depth (from and including the folded view-finder to the bottom of the camera). This extra space allows room for a sponge rubber pad to protect the view-finder. Add two inches to the height of the camera. This 2-inch space is for the lid, the inside of which is used to hold filters, exposure meter, etc.

Now, using ⅜-inch plywood for the ends and sides and ½-inch white pine for the top and bottom, build a box conforming to your measurements. Fasten the top in position. Take this box to your lumber yard and have them saw off the top two inches. By doing so, your lid will fit perfectly. Sand all surfaces carefully and round all corners.

You now are ready to cover this box with the same artificial leather covering you used on your camera. Secure 1½ yards of this material. Cut a piece long enough to cover the front, ends and back with a 1½-inch lap. Be sure that it is wide enough to allow extending it around to the bottom for 1½ inches and to the inside for the same distance. Use LePage's glue; spread it evenly on one panel at a time. Allow the glue to become tacky before beginning to apply the material. Start with the front panel and work so that the lap comes at one end of the rear panel. Work slowly, working out all air-bells and being sure that the material is making good contact. Make necessary cuts and laps as you go along and no difficulty will be experienced. When this is completed, cut a panel for the bottom and glue in place.

The inside of the case is best covered with five panels cut to fit, the bottom being put in last to cover up any inaccurate cuts. Now proceed in the same manner to cover the lid. Before covering the inside of the lid, secure one of the new bakelite handles that are found on portable typewriter carrying cases. Fasten this handle in place, countersinking the under parts so that your covering will be applied to a flat surface. Secure one yard of one-inch elastic and form loops to fit those filter cases, etc., you will carry with you. These loops are formed by using a ⅜-inch bright metal screw and a washer to hold them in place.

Next make two partitions about 5½ inches high from 3/16-inch plywood. Cover with the material and fasten them in place in the bottom of the case with two small angle irons, one on either side. In the center section thus formed, place a sponge rubber pad to absorb shocks that might damage your camera.

Fasten the lid to the box with bright metal hinges evenly spaced to give greatest strength to the lid. Secure two draw-bolt hasps of the same finish metal and eight box corners to protect the case from those inevitable bumps. Four domes of silence will protect the bottom and one or both of the camera bed supports you previously removed can be used as a lid support. A coat of leather dressing or wax will complete the case.

Lens

As a substitute for the usual long focus lens used in aerial work, we used the lens taken from an old Eastman Special post card-size camera. This lens is an f 6.3 mounted in an Optimo shutter. It has ample speed, even with a heavy filter, to get well exposed negatives on a bright day.

Film

Use only the new fast, panchromatic films now available. They will make up in speed what your lens lacks.

Filters

Always use either a "G" or "K-2" filter. Confine your picture-taking to those days when light conditions will permit you to use them.

Exposure

By shooting only on bright sunlit days, using Eastman Super XX film, nearly all our negatives were taken at 1/300 f 8 or f 11 with a "G" filter. Over-exposure will give disheartening results. Experiment until you learn to accurately judge the light while in the air. Stick to a constant shutter speed of 1/300, stopping up or down to meet light conditions. Unless you are working for special effects, always have the sun falling across the camera field (that is, on your right or left). This adds depth to your pictures. Work between the hours of 8 and 10 a. m., and 2 and 4 p. m. for best results.

Planes

The easiest and most comfortable type

(*Continued on page* 89)

LUSCOMBE TRAINER

8B1

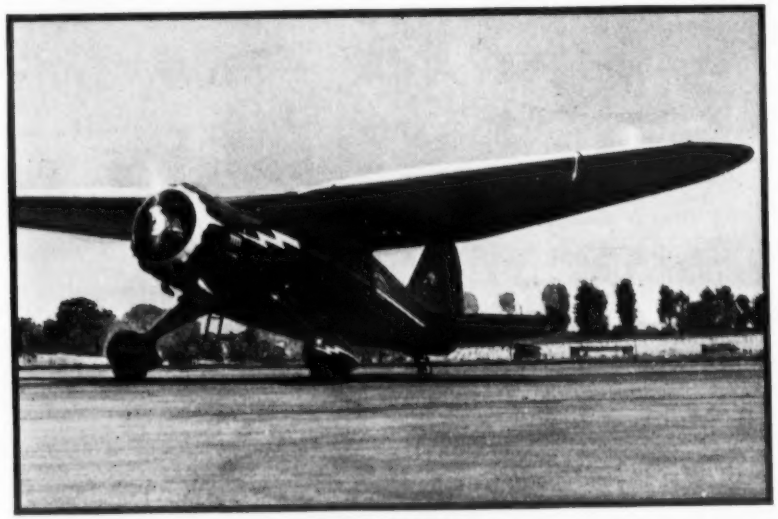
Luscombe Airplane Corporation — West Trenton, New Jersey

REARWIN

Cloudster, 8135

Rearwin Aircraft & Engines, Inc. — Kansas City, Kansas

AIRCRAFT



STINSON

Reliant, SR-10E

Stinson Aircraft Corporation — Wayne, Michigan

AIRCRAFT

WACO

V. K. S.

The Waco Aircraft Company — Troy, Ohio

REARWIN — Cloudster, 8135

COSTS: List price: $4,495. Minimum down payment: $1,498.33. Annual insurance premium: $720. Operating cost per hour: $5.50.

PERFORMANCE: Miles per gallon of fuel: 17. Cruising speed 125 m.p.h. Maximum speed at sea level: 140 m.p.h. Stalling speed: 48 m.p.h. Cruising range (excluding 10% fuel reserve): 625 miles. Service ceiling: 16,000 ft.

SPECIFICATIONS: A. T. C. No. 711. Type of airplane: CLM. Type of construction: Welded chrome steel tubing, fabric-covered. Engine: 120 h.p. Ken-Royce 7F. Fuel capacity: 34 gals. Weight empty: 1,130 lbs. Weight loaded: 1,800 lbs. Span: 34 ft. 1½ in. Height: 7 ft. 4 in. Wing area: 161.8 sq. ft. Wing loaded: 11.125.

ACCOMMODATION: Number of seats: 3. Baggage: 100 lbs.

EQUIPMENT: Instruments (standard on this model): Airspeed indicator, altimeter, tachometer, oil pressure gauge, oil temperature gauge, compass, switch, two fuel gauges.
Other equipment: Exhaust manifold, carburetor heater, NACA cowling, altitude mixture control, Plexiglas windshield, brakes, parking brake, tail wheel, navigation lights, six-volt battery, ball bearing controls throughout, two cabin doors, dual controls, complete cabin upholstery, 50 lb. luggage compartment, fire extinguisher.
Extra equipment: Cabin heater, generator, landing lights, radio, electric starter, flares, float fittings, special instruments, wheel pants.
Propeller: wood, fixed pitch.

WACO — V. K. S.

COSTS: List price: $7,070. Minimum down payment: $2,354.31. Annual insurance premium: $689.32. Operating cost per hour: not available.

PERFORMANCE: Miles per gallon of fuel: 10. Cruising speed at 70% horsepower: 136 m.p.h. Maximum speed at sea level: 145 m.p.h. Stalling speed: 55 m.p.h. Cruising range (excluding 15% fuel reserve): 492 miles. Service ceiling: 13,000 ft.

SPECIFICATIONS: A. T. C. No. 648. Type of airplane: CLM. Type of construction: metal, wood, fabric. Engine: 240 h.p. Continental W670M. Fuel capacity: 70 gals. Weight empty: 1,960 lbs. Weight loaded: 3,250 lbs. Span: 33 ft. 3 in. Height: 8 ft. 4 in. Length: 25 ft. 4 in. Wing area: 244 sq. ft. Wing loading: 13.32.

ACCOMMODATION: Number of seats: 5. Baggage: 100 lbs.

EQUIPMENT: Instruments (standard on this model): altimeter, airspeed indicator, compass, electric fuel gauges, oil pressure gauge, oil temperature gauge, tachometer, ammeter, electric starter, 15 ampere generator, navigation lights, indirectly lighted instrument panel with rheostat control.
Interior fittings: Fabricoid trim (broadcloth optional), adjustable front seats, ash trays, hydraulic brakes, parking brake, dual rudder pedals, throw-over control wheel, fire extinguisher, tie down ropes.
Propeller: Curtiss-Reed, metal.

LUSCOMBE TRAINER — 8B1

COSTS: List price: $1,785. Minimum down payment: $595. Annual insurance premium: $178.50. Operating cost per hour: $2.59.

PERFORMANCE: Miles per gallon of fuel: 26. Cruising speed at 75% h.p.: 102 m.p.h. Maximum speed at sea level: 112 m.p.h. Stalling speed: 35 m.p.h. Cruising range (excluding 10% fuel reserve): 325 miles. Service ceiling: 15,000 ft.

SPECIFICATIONS: A.T.C. 694. Type of airplane: CLM. Type of construction: metal, fabric. Engine: 65 h.p. Lycoming 0-145-B2. Fuel capacity: 14 gals. Weight empty: 665 lbs. Weight loaded: 1,200 lbs. Span: 35 ft. Height: 5 ft. 10 in. Length: 20 ft. Wing area: 140 sq. ft. Wing loading: 8.6.

ACCOMMODATION: Number of seats: 2. Baggage: 55 lbs.

EQUIPMENT: Instruments (standard on this model): Altimeter, tachometer, airspeed, oil pressure, oil temperature gauge.
Other interior fittings: Upholstery on sides and front of cabin.

STINSON — RELIANT, SR-10E

COSTS: List price: $14,350. No standard minimum down payment. Annual insurance premium: 13½%. Operating cost: 13½ cents per plane mile.

PERFORMANCE: Miles per gallon of fuel: 8.1. Cruising speed at 71% h.p.: 153 m.p.h. Maximum speed at sea level: 161 m.p.h. Stalling speed: 60 m.p.h. Cruising range (excluding 10% fuel reserve): 810 miles. Service ceiling: 17,400 ft.

SPECIFICATIONS: A.T.C. No. 679. Type of airplane: CLM. Type of construction: fabric and metal. Engine: 350 h.p. Wright R-760-E2. Fuel capacity: 76 gals. Weight empty: 2,730 lbs. Weight loaded: 4,150 lbs. Span: 41 ft. 10½ in. Height: 8 ft. 7 in. Length: 28 ft. Wing area. 258.5 sq. ft. Wing loading: 16.0.

ACCOMMODATION: Number of seats: 5. Baggage: 150 lbs.

EQUIPMENT: Instruments (standard on this model): Altimeter, compass, airspeed, bank and turn, rate of climb, tachometer, oil temperature and pressure gauge, carburetor air temperature gauge, manifold pressure gauge, ammeter, fuel level gauge.

SPECIAL FEATURES: Vacuum-operated flaps, single strut, semi-cantilever tapered wing, hinged cowl, 15 amp. generator.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

The Aircraft Owners and Pilots Association, with Service Headquarters in the Transportation Building, Chicago, Ill., is a non-profit organization formed and composed of non-scheduled aircraft pilots and/or owners exclusively. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is devoted to news of importance to AOPA members and is of a non-confidential nature. Special releases are sent monthly to all registered members.

RECENTLY the President stated:

"Today 50,000 young Americans are licensed flyers and the number is growing by almost 2,000 a month. They are not all military pilots—but they are as ready to become military pilots as were the farmers of Washington's day to become riflemen of the line."

He could also have pointed out other vital factors, such as:

(a) The United States has 17,000 planes other than airline craft (a mere 340) and military.

(b) The United States and its outlying territories have at least 1,500 airports strategically located and *self-maintaining* that only these pilots and planes can and do use.

(c) Supplying new planes, skilled workers for both factory and field, complete ground staffs, and fixed-base operations are factors carried out by a complete government department of 4,500 employees, all uniquely devoted to *civilian flying.*

(d) *Only* light planes and light-plane pilots can operate off improvised and limited landing areas.

(e) *Only* civilian aircraft are available in quantity to replace super-valuable military equipment for non-combatant work such as transport, liaison, patrol, fire control, and troop control tasks and they are just as good or better (particularly economically) for this work.

(f) Unless *integrated to military use,* this establishment will be wasted in the event of war.

The President has pointed the way. AOPA (even before the President spoke) for almost a year has been researching in the *emergency value of the civilian pilot.* AOPA formed its Air Guard and eagerly studied Milton Knight's experiment with Civil Air Reserve.

It becomes clear that our military defense experts have *overlooked* this unique national asset. They are not to blame. No nation had this opportunity before, and our military have too much to do to prepare along classic lines to consider this new weapon. Our conversations with Army and Navy officers disclose so many uses for a trained Civil Air Reserve that 15,000 civilian planes and 45,000 pilots with accompanying ground staffs and equipment could be put to use *today* in the Defense Program. Actual work to be carried on by such a reserve is enumerated in detail in the AOPA Section available and distributed to our members this month. More to the point, this contribution has been brought to the attention of the appropriate officers of the Administration by AOPA and now awaits governmental action.

But perhaps most important, this material has not been presented in the form of mere ideas. It has been presented as a study and a *plan of action* and has been worked out in detail. AOPA Board member, L. P. Sharples, is in an admirable position to get AOPA's plans adopted by the government as he is a member of the Executive Board of the new Aeronautical Advisory Council appointed by the Federal Government.

Under AOPA'S plan, a Civil Air Reserve will be formed under the direction of the Civil Aeronautics Administration. Naturally, it will fall under command of the Army in wartime, but will be administered by the CAA as the Army at this time can't spare personnel for that task. All pilots *regardless of Army ineligibility* may enlist and all owners can volunteer their aircraft. They will be paid for the use of their planes on military missions. Pilots will receive partial financial aid while training and be paid compensation for military service. AOPA's plan is comprehensive and provides billets for ground crews and also provides for enlisting all facilities.

AOPA has *again* been in the front line carrying out the desires of its members to assist in national defense and *avoid being grounded on "M" day.* We anticipate that very soon the government will take over and utilize the unique abilities, experience, and equipment of our part of civil aviation.

Winter; Watch Out for Tires!

Although operation conditions are somewhat different from those of scheduled airline ships, we believe that non-skeds will be interested in a release of the Bureau of Safety Regulation, C.A.B., regarding the use of Retreaded Tires on Air Carrier Aircraft. Since non-skeds probably average more landings and take-offs than the average transport (particularly those engaged in student instruction off paved runways and operating heavier ships), the following may be a good tip.

We quote from the release (No. 16).

"Due to the increasing failures occurring to tires which have been retreaded and put in service on air carrier aircraft, the following restrictions are necessary, effective immediately.

"The use of tires which have been retreaded is prohibited on all air carrier aircraft until such time as an improvement in the method of retreading is made resulting in better performance of such tires."

Propeller Vibration

Several inquiries on the subject of vibration in metal propellers have reached the AOPA offices recently and we have taken this matter up with the CAA. John F. Warlick, Acting Chief of the Certificate and Inspection Division has recently issued an interpretation of CAR 04.61 with respect to propeller vibration. The reading of Section 04.61 is as follows:

"Propellers may be used on any engine provided that the certified power ratings, speed ratings, and bore of the engine are not in excess of the limitations of the propeller as certificated, *and further provided that the vibration characteristics of the combination are satisfactory to the Authority.*" (The italics are ours.—Ed.)

(Continued on page 68)

Philadelphia's Pylon Squadron of the AOPA Air Guard is shown above just after landing with medical supplies in a recent simulated disaster problem at Greenport, N. Y.

You Don't Say!

"Guinea Pigs"
Sirs:

It may be that our Government is as open as you are to suggestions from any one of us Civilian Pilot Training Program students, but it is mighty slow in letting us be heard. Instead, we are spoken of as "guinea pigs." The Government has learned about us "guinea pigs" and the "guinea pigs" have learned about their Government. The Government says that our knowledge of avigation is sadly inadequate when our boys join the Army Air Corps. We need more practice in cross-wind take-offs. We need practice in landing on small fields and in emergency landings. Yet the C.P.T.P. boys have found that the Government, after a year's experience, is still unable to furnish 15,000 textbooks on Civil Air Regulations, navigation and meteorology!

In the summer of 1940 I went to the ground school classes at a cost to me of $15. Classes began on June 27; *books arrived for our class on August 8.* In the fall of 1940 there was room for me in the group that received actual flying. I also found that I was supposed to go to the ground school all over again. *Books for our class this fall* (which ended December 11) *never did arrive.* The excuse given by the Government was that the Government Printing Office was too busy printing draft registration blanks to send us our books. This reminds me of a story about our admirals which was reported last week. One admiral said that it was impossible for the U.S. Navy to base its fleet at Singapore because it did not have the required number of oil tankers to supply those ships. Another admiral ironically asked the first whether he had thought of taking his telephone receiver off its hook and calling the head of the Standard Oil Company to see what he could do about it . . .

I strongly recommend that you take down your telephone receiver, ask permission to copy the official Government texts and be prepared to sell or give away at least 20,000 copies of FLYING in a special edition . . . This edition should be ready for distribution about the 20th of January when a new batch of (C.P.T.P.) kids begin to fly . . .

HARVEY LARSON.

La Crosse, Wis.

● Obviously, the Government Printing Office *did* have its hands full with draft material. But things have quieted down to near-normal now and textbooks should be forthcoming soon.—Ed.

Glasses
Sirs:

. . . Is there any place in aviation for a fellow who has to wear glasses all the time? Would it be possible for such a person to become a flight instructor? . . .

ARTHUR E. JACOBSON.

Elgin Ill.

● Civil pilot licenses are granted certain persons wearing glasses. The C.A.A. has set up basic requirements that must be met by such persons, however. This information can be obtained from the C.A.A. in Washington, D. C.—Ed.

Army Gratitude
Sirs:

["Movie Soldiers," FLYING AND POPULAR AVIATION, January 1941] was most interesting and I think . . . presented . . . in a very favorable light. The picture layout was quite effective and, outside of myself personally, I was very glad to see the department and staff receive some recognition. Your magazine, of course, is received with favor in the Service and I take this opportunity to compliment you and your staff. . . .

JOHN H. FITE,
Captain, U. S. Army Air Corps.

Wright Field, Dayton, O.

Wheels or Floats?
Sirs:

Will you please explain the notation under the picture entitled "Seagoing Sentinels" (FLYING AND POPULAR AVIATION, January, 1941, page 29)? How can a landplane, if catapulted off a battleship, get back onto the catapult again? They couldn't land in the water and, if there were carriers in the group at sea and the planes landed on one of them, how could they get back on the catapults of the *U.S.S. Mississippi*? I thought they had single-pontooned seaplanes on battleships.

HAROLD PRYOR.

Riverside, Cal.

Sirs:

. . . I thought catapult planes land in the sea alongside their base ship. . . .

DALE ARNOLD.

Orrville, O.

● Many thanks to the dozens of sharp-eyed readers who called us on this. Explanation: Vought-Sikorsky OS2U-1's come from the factory with both land and sea gear. FLYING AND POPULAR AVIATION's picture was taken during shore duty of the *Mississippi's* VO-3 unit.—Ed.

Distinguished Reader
Sirs:

I have been reading your excellent magazine for about five years, now, and I'm afraid I can't find any faults with it. I notice that Sergeant Robertson (FLYING AND POPULAR AVIATION, November, 1940, page 82) has difficulty in obtaining his copy every month. Well, I don't know where he's stationed, but I always manage to get mine on time. . . .

I can endorse his remarks about American aircraft over here. I, too, have heard nothing but praise for them. Pilots who have flown the Lockheed *Hudson*, North American *Harvard*, Brewster *Buffalo*, Martin *Baltimore* and Douglas *Boston* have been most enthusiastic about them. For myself, I've only flown the Curtiss P-36 (*Mohawk* to the R.A.F.) and a few lightplanes (Aeronca C-3, Piper *Cub* and Cessna 37), but they all have my admiration.

I was surprised to see, in the November issue, so many details of our new types—*Tornado, Stirling, Manchester, Whirlwind,* etc.; we all know about them in the R.A.F. but nobody dared write them up in the press. . . . Even so, you've left out a few of the new arrivals. Now you guess which! . . .

Before the war I used to get aviation periodicals from the U. S., Canada, South Africa, Germany, France and Holland, but I'm just a little bit short now, with Germany all over the Continent! Still, we'll soon have them out of it! (PROPAGANDA—please note!). . . . I hope the censor doesn't get too busy on this. . . .

DONALD A. S. MCKAY,
Sergeant-Pilot, R.A.F.

Hawkinge, Folkestone, Kent, England.

● Thanks to Reader McKay for a highly interesting letter — which the censor didn't mar in the slightest. Since receiving this letter, we learn that Sergeant-Pilot McKay recently was awarded the Distinguished Flying Medal — highest honor to an enlisted flyer—for his prowess and score in flying against the German air force.—Ed.

Inferior?
Sirs:

. . . Is it possible that, of the 3,000 American-made planes shipped to (Britain), all are merely usable as training planes or in the Near East or Egypt against planes of Italy, whose fighters are not comparable? After all, the pilot training center of the British Empire is Canada; why would *she* not want these alleged training planes shipped there? Do you think our planes are deficient in protection and fire power? If so, why would England buy so many American ships? Why would she not . . . send us the blueprints of the *Hurricane* and *Spitfire* instead? . . .

ABRAHAM J. LAUFER.

Brooklyn, N. Y.

● As *aircraft,* U. S. planes are the finest in the world. But as *warplanes* American ships have been inadequate, as we have pointed out editorially during the past several years (see page 4). But all credit is due our Army and Navy for "catching on" quickly. All U. S. warplanes now are being equipped with the newest in protective materials (armor, self-sealing tanks) and their fire-power has been stepped up tremendously (the Bell *Airacobra* for the British has eight machine guns and a 37 mm. cannon).—Ed.

Younger
Sirs:

I saw in (FLYING AND POPULAR AVIATION, November, 1940, page 49) that a 17-year-old boy soloed a bi-motored Cessna and had 30 minutes in it. Also, he had about 400 hours. I think I have a son who can beat that.

Charles Bing soloed the day he was 16. . . . When he received his private license has was the youngest person in the state to have one. He now holds commercial license No. 45060 with 1S and 2S ratings. He also has primary and secondary instructor's ratings. He received his commercial license two months after he was 18 and, at present, is the youngest pilot holding this license in Virginia. He

(*Continued on page* 68)

AIRCRAFT RADIATORS

by RAOUL J. HOFFMAN

AIRPLANE engines may be cooled by air passing over the engine, or by a liquid which is transferred to a unit cooled by the air. This unit is the radiator.

Off-hand, it appears that liquid cooling should be of higher efficiency. Engine designers, however, managed to obtain equivalent results with direct cooling, with the additional simplicity of installation.

The upper sketch in Section 1 shows fins for air cooling and the lower sketch, the liquid cooling of a cylinder wall. Fins for air cooling must be cowled in a manner so that the air passes between the fins. Turbulency devices placed in front of cylinders increases the efficiency by about 30 per cent. A 15 per cent increase of cooling efficiency has been obtained by vibrating the radiator. Usually the running engine will create the necessary vibration.

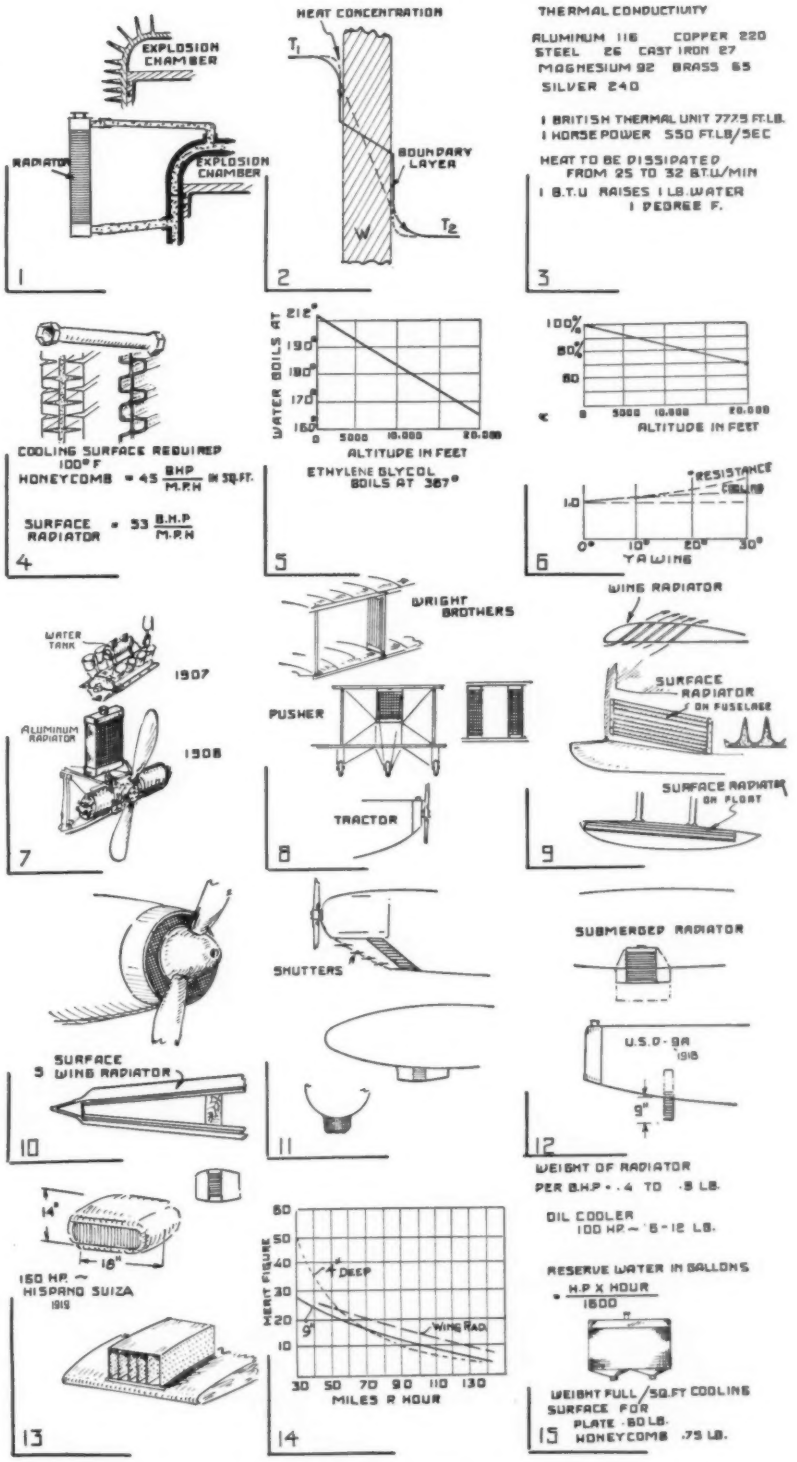
The basic characteristics of heat transfer process is illustrated in Section 2. Heat is transferred from the inside to the outside through the wall W. At the surface of the wall is a film of gas or fluid of infinite thickness. This film or boundary layer offers considerable resistance to the transfer of heat as indicated by the temperature difference of T1 and T2, exclusive of the drop through the wall. The temperature drop within the wall depends on the kind of material used. Coefficients of conductivity of materials are given in Section 3. Sterling silver has the highest value. The transfer of heat from or to the wall will depend on the speed of the fluid (air or water) along the wall. The slower the temperature drop through the wall is, the closer will be the temperature with the contacted medium. This may cause heat concentration at some points of the cylinder. The resistance of a plate to heat transmission is in direct proportion with its thickness and the conductance in indirect proportion with its thickness. Therefore the material used in radiators should be thin —usually from .004 to .006 inch thick.

Radiators are made of an assembly of round tubes with expanded ends, which prevents the round portion from coming into contact and thus forming the water passages. The hexagon ends are soldered to form a radiator block. The head resistance of a honeycomb radiator is equal to the resistance of a flat plate having an area of 60 per cent of the frontal area of the radiator. The resistance will be the same for two-inch up to nine-inch deep radiators made of ¼-inch diameter tubes.

Radiators of low manufacturing cost are made of ribbons stamped and soldered together. Two sketches of such designs are shown in Section 4. In the same section empirical formulas are given for estimating the cooling area for a honeycomb and for a surface radiator, if the cooling medium is water.

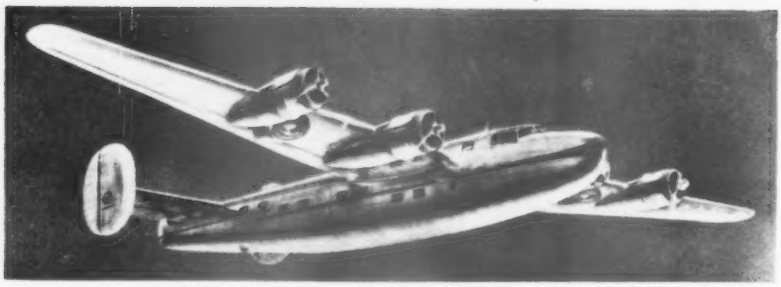
The area is usually estimated for the speed and power obtained when climbing.

(*Continued on page* 82)



Diagrams by the author illustrate aircraft radiator evolution.

HAVE YOU SEEN ?

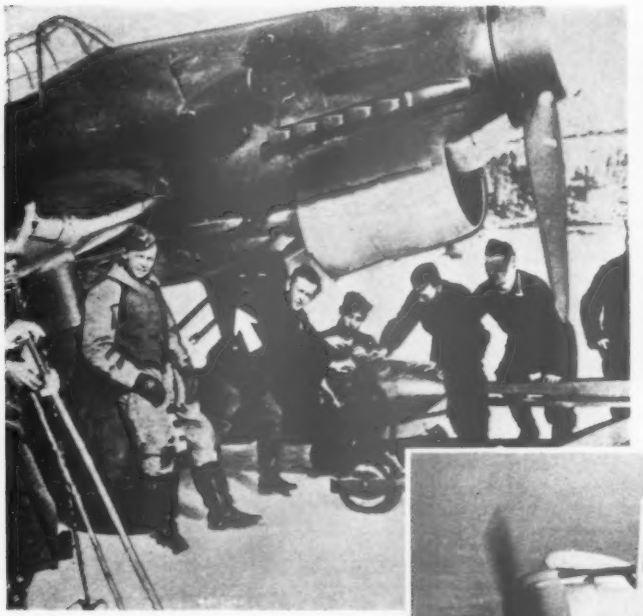


Commercial version of Consolidated's B-24 bomber is the Model 32 (sketch above). It will be powered with four 1,500 or 2,000 h.p. engines, will have supercharged cabin.

Stearman-Jensen "Ariel" has 80 h.p., has not yet received its A.T.C., probably will sell for about $2,500. Built in Coffeyville, Kan., it has top speed of 115, lands at 40.

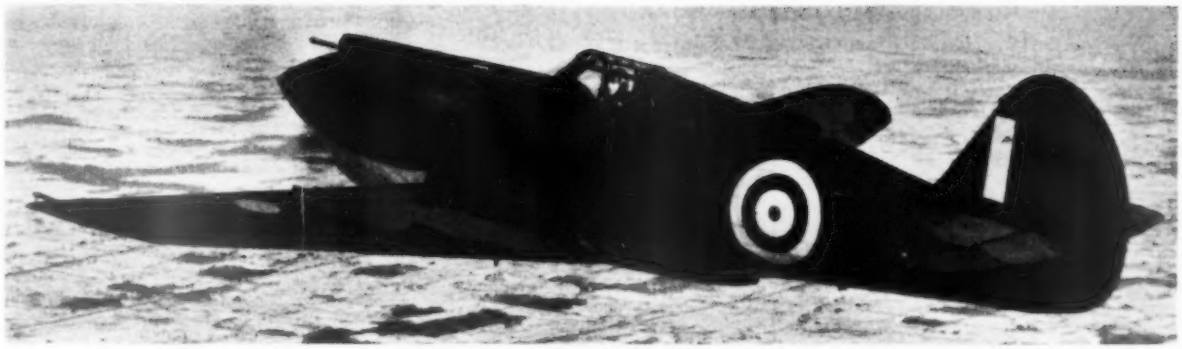
Above is latest picture of Piper "Cub Clipper" during test.

Newest Taylorcraft is two-tone, has 50-pound load increase.



New Douglas SBD-1 dive bomber (right) has arm under fuselage to swing bomb down past propeller arc. Device first was used on German Ju-87 (above; note arrows).

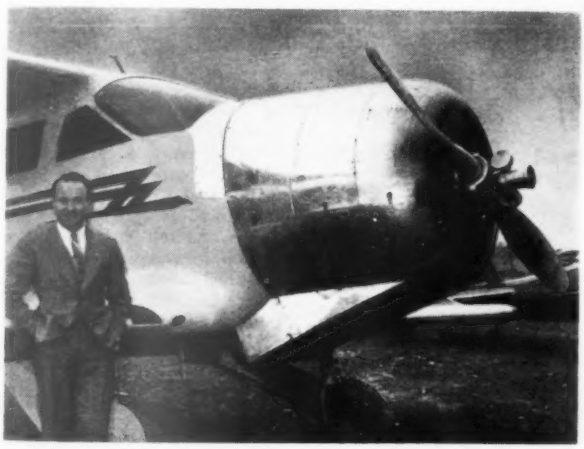
Airplane fabric made of glass has been tested on Taylorcraft. Fireproof, the new fabric is stronger than cotton.



Above is first flight photo of Curtiss "Tomahawk" (P-40) for R.A.F. Eight per day are being built.

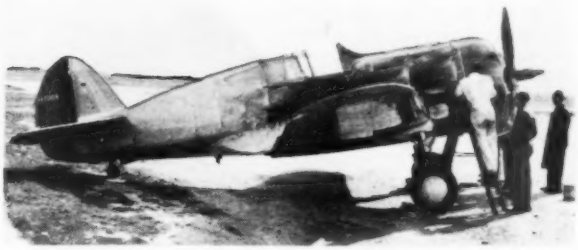
Another new lightplane, not yet approved, is the Call Model A, now being test flown by the Call Aircraft Co., Afton, Wyo.

This is Author Robert A. Winston's recent forced landing in the ocean off New York. Note his plane's number: 13.



Now being tested for single-engined Beechcrafts is this new cowling, completely closed at rear of 450 h.p. "Wasp."

First plane of new Northrop company is N-3PB for Norwegians. It has five machine guns, one cannon, top speed of 230 m.p.h.



Special P-36A (above) is a new Curtiss-Wright test plane.

The CPTP . . .?

(*Continued from page 31*)

that competent fixed-base operators whose fields largely had been idle, be given a part in the training program. He also felt that aviation should be given a permanent place in the American college curriculum by giving the ground school part of the training in colleges.

As a result of his efforts, the Civil Aeronautics Authority arranged for ground courses to be given in 33 colleges and flight instruction at 33 neighboring airports. The experiment was successful. More than 600 private pilots were turned out without a single fatal accident.

The next year, the CAA was given $4,000,000 with which to set up a regular program. Ten thousand were put through the 35-to-50 hour dual and solo course. For the following year (1940-41) $37,000,000 was appropriated by Congress and a goal, now being reached on schedule, of 45,000 private pilots and 9,000 graduates of the secondary course was set for the year.

The program is proceeding at 761 colleges. More than 40,000 young men and women already have won their private licenses through the CPTP since its inception. The bare figures do not give an idea of the achievements of the Federal Government in its encouragement of civilian flying. Private flying as a result is no longer restricted to the centers which are better endowed as to weather, facilities and wealth. Opportunities for private flying have been brought even to remote places whose young people had had scarcely any chance to see a plane on the ground, much less fly one. Tarkio College won the CAB award last summer for maintaining the best ground school. Its neighboring airport took the corresponding award for the best flight course. Dean Jennison, in accepting these awards, told of Tarkio and its remoteness in northwest Missouri, its 300 students and how the airport and air school were established only because the Federal Government's encouragement had assured their use. A look at the map tells the story of the wide spread of the CAB program better than a page of words.

Airport operators, even in centers which have always been considered air-conscious, have been placed on a sound financial basis for the first time. They carried the torch for aviation during the lean years and there have been far too many lean years. It is only just that they should have benefited from the CPTP. The program, incidentally, is costing the Government much less because of the use of these existing facilities.

The commonest cause of private accidents is pilot error. This could be reduced materially by teaching the student more carefully, the CAB reasoned. It therefore designed a standard course, based on the Army's primary course which was far more thorough than most of those previously given privately. It also raised the standards for instructors. For those unable to meet the new requirements, refresher courses have been given. Nearly 2,000 airmen have taken them. Private as well as CAB students have benefited from the raised standards.

One of the improvements incorporated in the CAB course is the principle of alternating dual and solo periods until 35 hours altogether have been piled up. This enables the instructor to keep close tabs on the student. In the past too many learners, once they have soloed, have simply been turned loose to "graze," acquiring many dangerous habits while running up the 35 solo hours needed for the private license.

"He just took one look at it and pulled his ripcord!"

One of the sharp criticisms directed against the CPTP right from the start has been its insistence on two years of college as a prerequisite. With few exceptions, the course is given only in colleges for this reason. This denies the opportunity to learn to fly to hundreds of potential flyers. The connection between air-worthiness and a college education has hardly been proved. The requirement was established because the Army requires two years of college for its flying cadets. Even at the time the program was started, however, a reservoir for potential Army cadets was visualized, although not prominently. It was thought best at least to line up the CPTP's requirements with the Army's.

The CPTP began to turn away from its original purpose—encouraging civilian flying and the civil air industry, with scarcely a thought to military needs—about a year ago. The jump in its appropriation from $4,000,000 to $37,000,000 came about because Congress wished to increase the size of the military pilot reservoir. The CAA also tried out a secondary course whose graduates completed the equivalent of the Army's primary training.

The secondary CPTP course was tested with 78 students who received an average of 40 hours more instruction and practice. The equipment used is similar to that used in Army primary schools. The advanced students learn aerobatics and elementary formation flying. By the time they are through, they have received 200 hours of ground school and about 80 hours of air-work altogether. Four thousand trainees will have finished the secondary course by the time this appears.

Among other changes instituted at about the same time, new students were required to pledge to join the Air Corps in case of a national emergency. There are indications that this clause has resulted in a drop in enrollment in recent months. According to Secretary of Commerce Jesse Jones and the CAB, 2,600 CPTP trainees have been accepted by the Army and Navy. They will probably enter somewhere in the primary course, depending on their individual ability and on how far they went in the CAB program.

There are two "guinea pig" classes (more than 70 in the Army and 85 in the Navy) to determine whether those who have finished the secondary course can enter the armed services' intermediate courses directly. This will help measure the military value of civilian pilot training.

A strenuous argument is raging in Washington right now over this very question. It reached its head with the appearance of the new budget, cutting this year's CPTP appropriation in half. It is difficult now to make a final judgment on the military value of the program. Here are the arguments on both sides:

The armed services dispute the CAB's figure of 2,600. Rear Admiral John H. Towers, Navy Bureau of Aeronautics chief, told the House Naval Affairs Committee that there were only two CPTP graduates in the Navy and two in the Army. He made no mention, however, of the "guinea pig" classes. In addition, a name-by-name check by CAB officials of CPTP graduates indicates that more than 1,100 are actually now in the Air Corps. Two months ago more than 800 were waiting to be called, according to the same source.

Spokesmen for the armed services feel that military discipline is necessary from the very inception of a course in military flying and that its lack is one of the weaknesses of the CPTP. They also feel that

(*Continued on page 72*)

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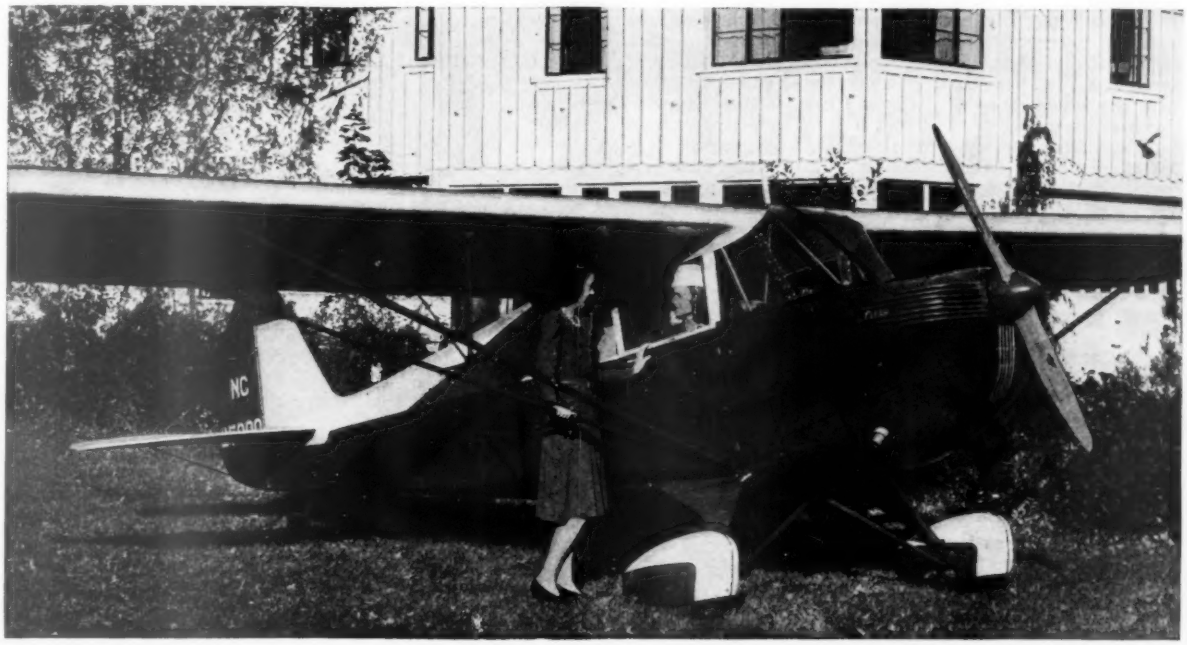

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Want a Job?

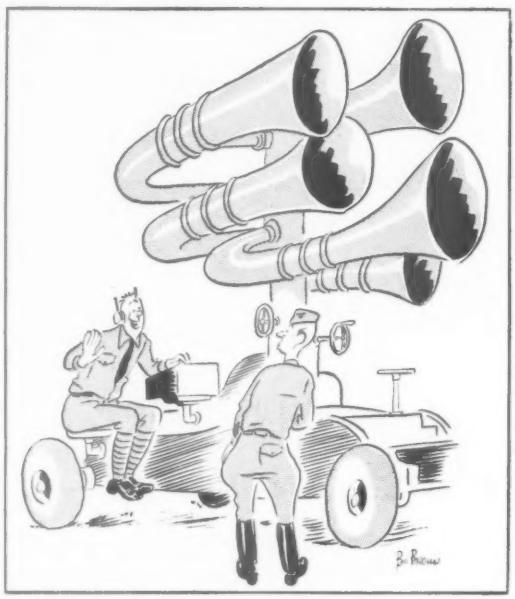
(*Continued from page 47*)

branch of the industry will do nip-ups out of sheer joy whenever he encounters one of them.

* * *

We've had so many letters this month that we're going to have to group them into various categories instead of answering them individually. M. K., our editor, can't—unfortunately—give us unlimited space, F. & P. A. being, as it is, concerned with the whole range of flying and not just a single phase.

We've had a number of letters asking how to get into clerical work, both in the manufacturing industry and in various other branches of aviation. Fortunately, the qualifications that are looked for by employers for clerical workers are almost universally the same—whether those workers are to be employed by an airline, or a manufacturer of steam winches. In the last two issues, we've given you job analyses covering the minimum requirements for: (a) sheet-metal worker (riveter's helper), and for: (b) junior draftsman. This time, we're going at it in a different way. We're going to outline the highest qualifications an employer would look for when he is hiring a man or woman for clerical work, then let you decide how many of these qualifications you possess. They will not expect you to have all of them, but they will insist that you have most of them—plus a pleasant personality, adaptability and a knack of getting along with people. In a factory, you'd probably be started as a driver of an electric parts truck. From this you may work into a good job in the production department. Possibly your starting job might be that of a stockroom clerk. Or—if you were employed by an airline—traffic or operations clerk. Advancement will depend on your learning something about the problems and company routines of the particular business in which you are employed.



"Wow! You oughta heard what the captain's wife just called him!"

Job Analysis

POSITION: Clerical worker. (Maximum starting qualifications. Persons with considerably fewer qualifications are often hired, particularly if they are recommended by, or related to persons who are already employed.)

WORK DONE: Checking parts in and out of stockrooms by means of a perpetual inventory. Taking parts to bench workmen. Typing or secretarial work for executives or minor department heads. Bookkeeping. Work in accounting, material, payroll, purchasing, or other similar offices. Similar jobs in air line operations or traffic. Does not require a knowledge of mechanical trades, processes or higher mathematics, although such knowledge will immensely increase the possibility of employment. The ability to operate any business machine is advantageous. Clerical workers must be alert, adaptable and intelligent. Personality is at a premium. A knowledge of the basic principles of the business is highly desirable. Often, in these hectic days, the ability of persons employed in clerical positions to control their tempers and their nerves and to be quietly efficient is worth more than a college degree. Often too, through sheer efficiency, minor clerical workers find themselves in good positions merely because their superiors discover that they are doing more than their share of work—voluntarily. This, naturally, applies to women too. We've had a few inquiries from women who want to get into the industry. Some had excellent qualifications. We feel sure that people like them would be a definite asset to a harried and overworked department head—although their first jobs might well be typing apparently meaningless numbers on the top keys, hour after hour. Women who are genuinely capable will inevitably be chosen for secretarial work. After all, there is nothing that makes a busy man's work easier than a capable secretary; who will painstakingly pick up and take care of the many details he's apt to forget. And—just try to find girls who are that dependable! . . .

PROMOTIONAL FROM: Starter's job.

WAGES: From 50 to 75 cents an hour, depending on education and previous experience. (Wages vary through the country, depending on local conditions and the law of supply and demand.)

EDUCATION: In this particular category, it is hard to be specific. We have known college men who were "academic morons." On the other hand, we've known extremely brilliant people who have never been graduated from high school. In general, we will say that experience and dexterity in the operation of any business machine is a good qualification. Comptometer operators—usually female—will ordinarily meet a warm reception. So will Powers' Machine punch operators, trained accountants with banking experience, etc. Mechanical excellence in typing and shorthand is a negotiable commodity and is almost a prerequisite with girls who are seeking employment in any branch of aviation. Good stenographers (we are not talking about personal secretaries) are very rare. Most girls, either through a disinterest in their work or through ineptitude, make terrible and often expensive mistakes. We will say here that a college graduate in business administration who has had experience in the operation of business machines and who possesses a theoretical knowledge of the particular branch of the airplane industry in which he or she is seeking employment, would be a likely candidate for a job; provided, of course, that his or her personality was acceptable to the employer.

EXPERIENCE: Previous employment in any other similar field of transportation or manufacturing will help. There is nothing basically dissimilar between the operation of an airline, a railroad or a bus line. Neither is there any great difference between manufacturing radios and airplanes. The problems are similar and, if a person knows one field thoroughly, he will ordinarily be very adaptable to another. A good shipping clerk is, after all, a good shipping clerk.

POSSIBILITIES FOR ADVANCEMENT: The sky's the limit. We've taken men off material trucks who later became invaluable employees of the material, parts sales and production departments of one factory. They were, however, exceptionally intelligent, diligent and capable individuals. We might say also that clerical workers are often drawn from people who have been hired as mechanics.

* * *

We have had a few inquiries from welders. This is a ticklish subject. We know of no two manufacturers who have the same requirements. Ordinarily, however, no one who has not passed the Army and Navy examinations for steel or aluminum gas welders has much of a chance—either with the manufacturers or the airlines. This seems to be a standard qualification. Everyone in the industry is extremely fussy about the quality of welding—and with reason. Some manufacturers, however, do take men with basic welding experience as apprentices. In other cases, people who can do set-up work are later trained as welders. Welding is a craft that some people can learn and others can not. It might

(*Continued on page 82*)

HOW LIGHT PLANES AID PREPAREDNESS

Today — *right now* — America has more than 50,000 civilian pilots — pilots who received their essential primary training in *light planes.*

And hundreds of independent flying schools are training new thousands in *light planes* under the forward Civilian Pilot Training Program.

On the alert—this great army of civilian pilots is prepared to serve, within their capacity, in national catastrophes of floods, epidemics, *and defense.* Many are already in Army and Navy Air Corps — over 2600 CPTP graduates have enlisted and nearly 700 more are awaiting acceptance. Many others are building their flying experience in their own *light planes.*

Only with *light planes* can so many pilots receive primary training and multiply their experience so quickly. Only *light planes* can be built with the speed and in the quantity to provide adequate primary training facilities. The critical need for combat ships demands all large, fast plane production capacity. Existing industry capacity for *light planes* is now over 12,000 planes annually. Low in cost, inexpensive to operate, *light planes* fit the civilian pilot's pocketbook for training—and *keep* him in the air.

Serving our Nation's defense still further is the employment and training of many workers to replenish the serious shortage of skilled labor. *Light plane* manufacturers are conducting Vocational Training Classes — teaching metal trades, tool and die work, welding, painting, motor maintenance and repair, and other skills so urgently in demand.

Yes — the *light plane* is vital in National Defense. It is helping to create a Nation of Pilots — it is keeping them flying and ready for emergencies — it is expanding airplane plant capacity and increasing the supply of skilled workers. We are proud of the leading role Taylorcraft Airplanes are playing in this indispensible phase of national preparedness.

TAYLORCRAFT AVIATION CORPORATION
ALLIANCE, OHIO

TAYLORCRAFT

The Plastic Plane Is Next

(*Continued from page 25*)

phenols, exhibit low tensile strengths but high bearing strengths. Therefore, the marriage of these two materials results in an "improved wood" with good strength properties in both tension and compression. The use of this material to date has been somewhat limited in plywood aircraft construction. It is being used to reinforce the root ends of spars and the butt ends of wooden controllable pitch propeller blades.

It is reported, probably unreliably—that certain German Heinkels are made largely out of "improved wood." Fokker had long been using wood almost as freely as metal. In Italy such manufacturers as Caproni, Savoia, Piaggio and Cant have found plywood parts, particularly wings, to be the answer to heavy production of quality planes. Most of the British manufacturers have employed wood ever since production became vital. Bakelite's Plybond and Tego phenolic resin sheet glues are available there. No shortage of phenolic resin has yet been felt in Britain.

In 1933, 1934 and 1935, American experimenters joined the plastic bandwagon. In 1937 and 1938 the volume increased. First the smaller companies, free from red tape and the inertia then in Government circles, started it. Haskelite Manufacturing Company shared the honors for Duramold with Fairchild Engine and Airplane Corporation; and the Hughes Aircraft Division of Hughes Tool Company took more than casual interest in the material. The Aircraft Research Corporation of Bendix, N. J., developed Gene Vidal's process for making Weldwood. The Timm Aircraft Company of Van Nuys, Cal., came out with Aeromold, which embodied a modified plastic bonding material. A new phase of airplane manufacturing had begun.

Governmental interest became centered in the new field. The Plastics Section of the National Bureau of Standards began experimenting with resin-bonded plywoods and veneer-reinforced plastics under the sponsorship of the National Advisory Committee for Aeronautics. The industry began watching the new planes in action. Summit had an airplane body built by the Vidal process (which we'll soon discuss in more detail). Other manufacturers started using the process. Timm made an army trainer that attracted nation-wide attention. It encouraged the manufacturer to undertake an Aeromold military pursuit ship patterned after Howard Hughes' racer which crossed the continent in 7 hours and 29 minutes.

Plastic-bonded plywood infiltrated into aviation from all sides. Today there are few airplanes that do not use it in some parts and an increasing number is using it for monocoque and semi-monocoque constructions. Even the most stubborn of the metal advocates are softening up when it comes to the question of plywood wings.

Plywood bonded with plastic is most practically made by the manufacturers in flat sheets and these sheets used by the plane-makers for wing skins. This is the big, serious, volume of the plywood employed in plane-making. Even the smallest of manufacturers are equipped to use the ready-made plywood in their assemblies. But new manufacturing techniques have also appeared—manufacturing techniques as fresh and novel as the material itself. Most have the common characteristic of combining wood veneers with the plasticity of resins in molding and setting airplane structures; these forming processes relieve internal strain. Sometimes veneers are in the form of flat sheets, sometimes in inch-wide strips interwoven or otherwise arranged so as to distribute the direction of the fibers more evenly without sacrificing strength.

"They didn't mention anything about these uniforms until after we signed the contract! . . ."

Claims, at first glance, seem extravagant. The materials are said to be immune from corrosion, waterproof, resistant to fire, capable of being flexed to almost any shape and then set. They're to be able to permit low-cost production of mass quantities of smooth-surfaced, lightweight, strong airplane bodies in a tenth the usual time.

Roughly, the molding process consists of applying heat and pressure to the alternate layers of plastic-impregnated tissue and veneer to fuse the club-sandwich-like plywood into a single unit. The plastic is softened and re-solidified in its original form (save that some of it will have penetrated the wood fibers enough to cause the fusing of veneer on either side of the plastic) or chemical action arrested by the lowering of temperature may continue and form the plastic into a hard solid. Currently glues and adhesives that set in colder form are being tried, as are bonding materials that set with less pressure.

The Vidal process may be employed by making a male mold of the exact inside proportions of the part of the plane specified. Wood is a favorite material for this mold. Veneers, possibly cut out on a blanking die to the desired flat pattern, are hung over the male mold after having been dipped into the resin solution and permitted to dry. After plastic and veneer are on the male mold Nabisco wafer style, the whole business is put in a rubber bag. This bag eliminates the expense of a female mold. As the air is taken from it, the folds of the bag draw tight around the veneers; veneers slip into position without much fiber stress being set up. The bag and its contents are inserted into a large steel tank in which steam builds up the required heat and pressure for the necessary length of time.

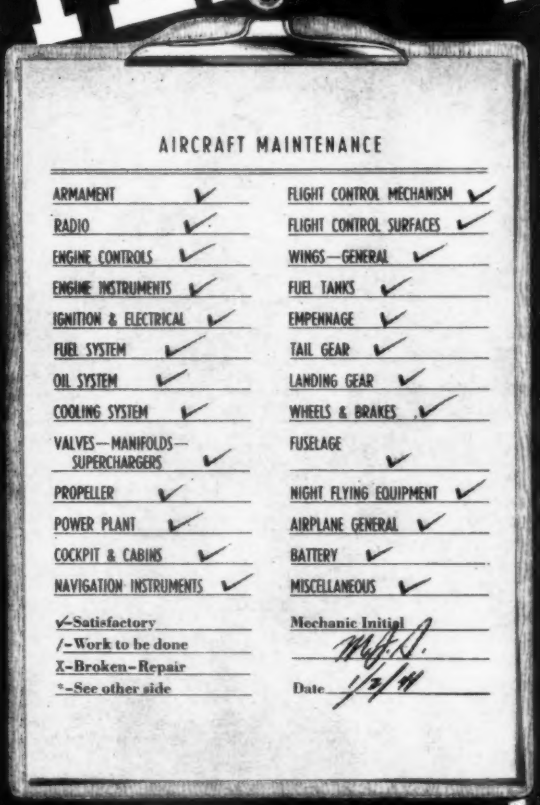
After that, out pops a molded part of the plane as neatly as muffins out of a well-greased tin. The little or no stress set up prevents any tendency for the veneers to spring back into their former shapes. All fibre strength goes to sustain the plane part.

Reinforcements can be set in place by the molding of the part. Spruce, African mahogany and other woods are processed in this manner. Reinforced fuselages, wings, elevators, flaps, ailerons, stabilizers, vertical fins, floats, sundry controls, bomb doors and nacelles already have been made this way. Fuselages are seamless from fireboard to tail tip. Wings are said to be 40 per cent lighter than metal ones. Power is said to have far greater utility. It costs no more to make the material curve than to mold it flat. Once forms are completed, neither expensive tools nor skilled labor are required to finish the parts. Modifications of this manufacturing method involve (1) the use of a rigid female mold and an inflated rubber bag for the male mold, and (2) the substitution of fluid (oil) pressure for the steam.

The United States Plywood Corporation has rights to the Vidal process outside of aeronautical fields, aeronautical rights to which are handled by Aircraft Research, Inc. Duramold, a second process, is employed both with flat and curved surfaces. Whereas Vidal uses both thermosetting and thermoplastic bonding agents, depending on the specifications, Duramold lays heavy emphasis on the merits of thermosetting bonding agents. Former chief engineer of the army air service and present head of Clark Aircraft Corp., Col. V. E. Clark, is largely responsible for the success of Duramold in aircraft construction. When he built planes during the last World War he felt the limitations of the plywoods then

MAINTENANCE

WITH EASE AND ECONOMY*



NORTH AMERICAN AVIATION, INC.

INGLEWOOD, CALIFORNIA, U.S.A.

* STANDARD U. S. ARMY TIME OF OVERHAUL FOR N. A. A. TRAINERS 2500 HOURS

available and experimented with Haskelite Duramold to get a plane with molded fuselage with a resin-bonded skin on the wings. In early experiments the veneers and plastics were placed over cast iron dies, an air bag under pressure was tried on the outside and the inside of the die was heated to cure the plywood. This was found impractical because of the cost of the die.

It was followed by female dies of sheet steel, cast metal and wood; the male, flexible, part of these early dies was the rubber bag. These flexible dies were found to give equal pressure to all parts and the pressure was at right angles to every area. Molded fuselage, wings, nacelles, pontoons and spars are mounted on forms and the retaining bag placed over the whole. Then it goes into a tank. Duramold's newest tank, at Grand Rapids, Mich., is 10 feet in diameter, 28 feet long. The quick-acting doors of the thing weigh 13 tons alone. In the tank, 110 pounds of pressure per square inch is applied. A half-inch thickness takes only about 15 minutes in the tank to be permanently set.

The third process—Aeromold—uses dies and heated presses to stamp out the blank shape before molding the veneers and plastics into planes. The big secret of this process is its plastic which doesn't require a great deal of heat and pressure to be set. The parts are pressed in precision molds to the contours desired and are then taken from the press and baked in a 10 x 10 x 40 foot oven at 100° F. They are then assembled on a skeleton framework with a simple master clamping arrangement which holds a whole wing or fuselage section on the frame at once. Upper and lower molded halves of wings, of some models, are fitted over regular spar and rib systems and later sealed. Spruce is used in solid laminated form for spars. Three-ply resinous bonded plywood is used for some ribs. Spruce veneer impregnated with resin is this method's pet material. Sometimes the cold-setting phenolic resin starts to harden before the workers are ready for it. A dousing with a hose stops that.

The finished assembly is baked for two hours at 180° F. This baking fuses the separate elements into a single plane-mass. The pressure on the body surfaces vary between 50 and 150 pounds per square inch. A plastic paint is used for finishing giving a surface so smooth "a fly couldn't light on it without breaking a leg." Timm is the principal user of the Aeromold process.

The three processes have essentially the same advantages of sealing the wood so that it becomes waterproof, oilproof, free from fungus, bacteria and insects, resistant to fire and shock (more so that aluminum alloy of comparable strength) and other features which we've covered.

We've only scratched the surface of this new type of production. The long, straight-grained sheets of veneer pressed into cohesive masses with phenolic resin and other plastics are finding their way from aviation into other fields. Auto fenders and bodies, boat decks and hulls, units of pre-fabricated houses, hangars and other structures, truck bodies and freight cars—these are just a few of the present or potential users of this new type of wood, the wood that took wings.

END

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Nazi Warplanes

(*Continued from page 17*)

and is its heavy bombardment plane even today. The series numbers on the latest He-111Ks are H or No. 8 in the modified types. It is a large machine as the following tabulation will show:

Span, 74 ft. 3 in.; empty, 14,400 lbs.

Length, 54 ft. 6 in.; disposable load, 10,600 lbs.

Height, 13 ft. 9 in.; gross, 25,000 lbs. Maximum overloaded, 27,400 lbs.

Nearly 20 feet less span in the He-111K is carrying slightly over a ton more load than the Douglas DC-3 of approximately the same class, as to power. The normal gross of the He-111K is the absolute maximum for the DC-3. Where the DC-3 cruises at 190 m.p.h. at 7,000 feet with its 1,100 h.p. *Cyclone* motors, the Heinkel buzzes along at 215 m.p.h. Where the Douglas has a range with full load of 1,100 miles, the Heinkel has 2,100 miles. The Douglas lands at sea level at 65 m.p.h.; the Heinkel at 74.

The British report that the Heinkel is a nice airplane to fly, comfortable and maneuverable. It is well-built and well-planned. It is entirely of metal with the

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sez' Joe Plosser

Joe Plosser Air College
1435 Flower Street
Glendale, California
January 6, 1941

Mr. E. E. Porterfield
Porterfield Aircraft Corp.
Kansas City, Missouri

Dear Mr. Porterfield:

You are aware that the Joe Plosser Air College is situated at the Grand Central Air Terminal in Glendale, California and is one of the government contract schools working on the Civilian Pilot Training Program.

We started our government contracts a little over a year ago and were using four different makes of light airplanes for our training. We experienced some difficulty in switching the students from one type of trainer to another, so we decided to standardize. The next question was, what make of trainer should we select. Our flight instructors and students assisted us in selecting the Porterfield Trainer. The reports came in that the Porterfield has ample room for a large pilot plus a parachute in both cockpits; visibility from either cockpit is good; brakes in both cockpits assures ground control from either position. The flying characteristics of the Porterfield is as economical to own and operate as any of the other makes, and far more so than some.

We are using Porterfields exclusively for our quota of forty Primary students—also for our Instructor and Commercial refresher students. A fleet of seven of these Porterfield trainers assures us that our students will receive their flight appointments regularly.

You may be sure that we appreciate the effort and the workmanship that you and your factory are putting into these fine training airplanes.

Very truly yours,
JOE PLOSSER AIR COLLEGE
Joe Plosser

Sincere wishes to you for continued success in the year 1941..

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Present Position.....

Canadian residents send coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada. British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England.

standard German flush-riveting. The pilot sits on the port side of the unsymmetrical nose. He has no extruded cabin, merely sitting in a fully streamlined and pointed nose section which is highly efficient aerodynamically. This nose is almost entirely Plexiglas so that, despite being sunk well inside the fuselage, the pilot has wonderful vision and must feel very exposed.

Instruments (of which there are a full complement) are arranged on a dashboard on the cabin roof. Throttles are at his left side as in a single-engined ship. There is no co-pilot's place, although the wheel control may be lifted over as in American Waco biplanes and other small craft, so an auxiliary or relief pilot may fly the Heinkel from a makeshift seat. Because the pilot is open to glare of sun or searchlight, circular glare shields that resemble fans that once were standard equipment for milady in the Victorian era, are fitted on the control column, on the roof and at each side of the cabin. When not unfolded into their round shield shape, these fans collapse into a compact line.

At the pilot's right is the tip-up seat for the navigator-bomb aimer. A padded trap in the floor covers the bombsights, which are used by lifting off this cover. The bomb aimer also becomes the front cupola gunner in combat, fitting a single .312 caliber gun on a pin fitting that is not particularly maneuverable nor does it have an effectively wide field of fire.

Behind the pilot is the bomb compartment between the wing spars. Bombs are carried in vertical racks and provision is for eight 550 pound bombs in most ships examined thus far. With this bomb load of 4,400 pounds the ship is given a maximum fuel load of 760 gallons weighing 5,700 pounds, since these are Imperial gallons (one quart more than standard U. S. gallons).

The rear top gunner has a swinging cradle seat from the roof. The aft lower gunner lies in a trough firing a gun backward and downward. Two other guns have been provided the crew for firing directly out to port and starboard, since British fighters have commenced making what they call beam attacks to take advantage of the lack of protection at angles of 90° to the line of flight.

The loop antenna in the Heinkel is just inside the Plexiglas shield over the rear top gunner's firing position, where it adds no drag in flight. It is somewhat in the way of the gunner and, in one ship the British brought down, it was found the rear gunner had fired right through the mast holding this antenna.

A label found in the cockpits of the Heinkels gave the following flying directions: Take-off with propellers at 11.50 on the clock dials that show the propeller pitch position. At this reading they are in fine pitch and allow high revs. Take off and climb for one minute at 2,400 r.p.m. and 1.35 atmospheres of boost (a manifold pressure of about 38 inches of mercury). For continuous cruising below 19,685 feet, 2,100 r.p.m. and 1.10 atmospheres (30.8 inches of mercury). Cruising above 20,000 feet, 2,300 r.p.m. and 30 inches. In a dive, r.p.m. must not exceed 2,500. Flaps must not be lowered at more than 200 kilometers (124 m.p.h.) or 1,700 r.p.m.

The Junkers Ju-88A1 is a 25,000 pound dive bomber. Most surprising of all facts elicited from an examination of this plane is its size as evidenced by the following dimensions: span, 59 ft.; length, 46.6 ft.; height, 15 ft.

British engineers who examined several of these airplanes decided that it originally was conceived as a heavy bombardment plane but changed to a dive bomber when in production. The wing spars show how they were strengthened after originally conceived, the diving brakes were added afterward and, as a result, they do not retract into the wing but merely lie against its lower surface. Finally, there are the external bomb-racks for releasing of bombs in the dive when their release from internal racks became impossible.

The original Ju-88 was a two-crew bomber of highly streamlined shape and with two 1,200 h.p. Junkers Jumo 211 engines, did 324 m.p.h. for 1,200 miles over a two-way course in which wind could have had no effect. But the service form of the ship has a top speed of only 290 m.p.h. due to all these excrescences which cut down its performance radically.

As it is in service, it is capable of being used both as a dive bomber and as a horizontal bomber. There is a bomb-aimer's position in the nose, with a nose machine gun for horizontal bombing. The pilot also has a Zeiss dive-bombsight in front of his windscreen. This is altogether different than the horizontal sight.

Just what the maximum angle to which Ju-88's are dived is not known. One ship shot down in England had a diving line on the fuselage at 45°. This is the line which the pilot brings the horizon when diving at 45°. Others, however, have lines at 40, 50, 60 and 70° Apparently these were put on by the pilots at their own discretion. Dive bombing is not very effective unless it is done from angles of 60 to 80° when great accuracy and penetration is obtained.

The Ju-88s have one amazing feature—the so-called automatic pullout for diving. Actually, this device merely indicates to the pilot that it is time to pull out and helps him do this. It works like this:

When the diving brakes are lowered (by hydraulic ram) hydraulic pressure is applied to one side of a piston and moves the elevator servo tab to the nose-heavy dive position. When the bomb is released electrically, a quick-release of pressure on the piston comes into play and this reverses the servo control at the tail and endeavors to return the tab to level flight position. The pilot feels the movement backward of the control column and is helped in raising the nose.

For dive-bombing this plane carries four 500 pound bombs externally. In addition, internally for horizontal bombing it can carry 16 bombs each of 110 pounds. This gives a gross bomb load of 3,960 pounds. Total fuel capacity for the airplane can be 770 gallons. But maximum bomb and maximum fuel loads cannot be

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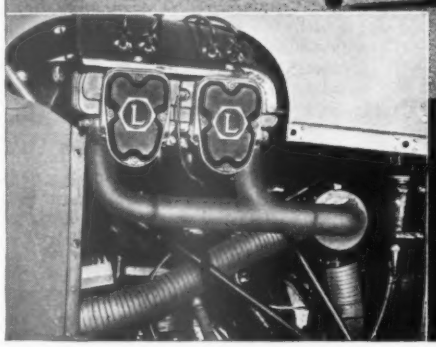

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Engines

FOR MILITARY AND CIVILIAN TRAINERS ★ FOR PRIVATE AND COMMERCIAL PLANES

combined. The plane can take either 510 gallons and its full bomb load, or its full fuel load and four 500 pound bombs.

The Ju-88 first came out with no defense under the tail—apparently its speed was expected to be its defense. But combat changed that. A backward firing gun was installed in a cupola under the nose. The one gun firing upward over the tail was augmented by three others.

A device unusual on American planes that the Ju-88 has as standard, is a "control surface brake." This is a hydraulic brake put on movement of all control surfaces at the pilot's will. Apparently it is put there to prevent flutter in its early stages. No brake could do anything against really well developed flutter, of course. But this is apparently used because speeds developed in dives have caused the Ju-88s controls to develop incipient flutter. This is a unique approach to the flutter problem.

Last of all, the Ju-88 has exhaust-heat wing deicing. Air taken behind the engine radiator is heated by contact with the exhaust stubs and then flows along piping to the leading edge of the wing. Here it enters a D-shaped duct formed by the curve of the leading edge and a vertical sheet of metal. In its passage the air heats the wing tip and is then discharged at the wing tip into the interior of the wing so that control hinges and pulleys do not freeze at high altitude. A standard Goodrich-type of pulsating boot deices the leading edges of the tail.

All the multi-engined German planes have the now famous German self-sealing fuel tanks. These are of five layers: the outer one of vulcanized rubber. Under this is a series of layers of partly hardened rubber. Then comes a layer of raw rubber that swells and plugs holes when gasoline reaches it. Under the raw rubber is a layer of tanned leather and finally the fuel is held in a fiber tank. The whole affair is light, immensely strong and works to perfection. It weighs about half a pound to the gallon—a figure comparable to that of dural tanks.

Because of space limitations we can merely touch on the German engines—Daimler-Benz and Junkers. Both types have direct injection of solid fuel into the cylinder and both have the fine hydraulic-coupled supercharger drive. This drive is similar to the fluid drive now developed for certain U. S. automobiles, with this exception: oil for the coupling is supplied according to an inverse ratio of outside air density. Little oil in thick air at the ground, much oil in the thin air at altitude. The result is that there is considerable slippage in the blower drive near the ground but great efficiency at altitude.

The effect is to prevent the engines from being abused by opening throttles on the ground. Many of these engines also have a mechanism that prevents them from being abused at take-off. This gives the pilot a pre-determined period of full throttle operation after which the engine will revert to its maximum power rating for continuous operation.

END

You Don't Say!

(*Continued from page* 54)

will be 19 next May, has finished instructing two C.P.T.P. primary courses, has instructed a flight instructor's refresher course and is starting on an apprentice instructor's course next week. He has flown Wacos, a Fleet, Stinson *Reliants*, a Fairchild "22" and "24," Rearwins, a Kinner *Sportwing*, Porterfields and Howards. He is at present working for the Lynchburg Air Transport and Sales Corporation at Lynchburg as a primary and secondary flight instructor. He now has about 875 hours. . . .

MRS. JULIA BING,

Blackstone, Va.

Phone Pole?

Sirs:

I have heard of telephone communication aboard sea-going ships, but using telephone *poles* aboard ship is an eye-opener. In the picture at the bottom of page 14 in your January, 1941, issue, can you explain what the Japs are up to this time? . . .

PAUL CARLSTEDT.

Huntington, Park, Cal.

● The "telephone pole" aboard the Japanese aircraft carrier *Akagi* is nothing more than a good, old-fashionned radio antenna pole, so obsolete on anything as modern as an aircraft carrier that it looks like something new.—Ed.

END

AOPA News

(*Continued from page* 53)

To determine whether the vibration characteristics of a propeller-engine-airplane combination are satisfactory it is necessary not only to determine the operating characteristics in flight but to measure blade vibration stresses under flight condition for each combination. Past experience has indicated that this procedure is necessary with all propellers except wood types. In some cases it is possible to determine the effect of changes or slightly new combinations by ground tests or comparisons of previous data, but in most cases flight test for this purpose are necessary. The propeller manufacturers have the stress measuring equipment necessary to accomplish these tests.

More Airports Offer AOPA Overnight Storage Rates

AOPA Survey Ships have reported the following additional hangar rate concessions for AOPA members:

Location	Regular Price	For AOPA Members
Ravenswood Airport Des Plaines, Ill.	$1.00	$0.75
Washington Park Airport, Homewood, Ill.	1.00	0.75
Stinson Airport La Grange, Ill.	1.50	1.00
Du Quoin Municipal Airport, Du Quoin, Ill.	1.00	0.75
Whitney Memorial Airport, St. Cloud, Minn.	1.25 up	1.00 up*
Marlboro Airport Marlboro, Mass.	1.00	0.75*
Bellview Airport Cairo, Ill.	1.00	0.50*

* Free transportation to town.

Pilots who know of other airports where special services are offered to AOPA pilots are encouraged to write AOPA National Service Headquarters, Transportation Building, Chicago, Illinois, for necessary forms.

AOPA Guardsmen

In reviewing the status of Air Guard Pilots we find that there are still some One Star courses outstanding. Pilots who have not completed their examination papers are urged to do so and mail them in to the Service Office as soon as possible. This is quite important and may be of special interest to Guardsmen in view of the plans for a Civilian Air Reserve.

END

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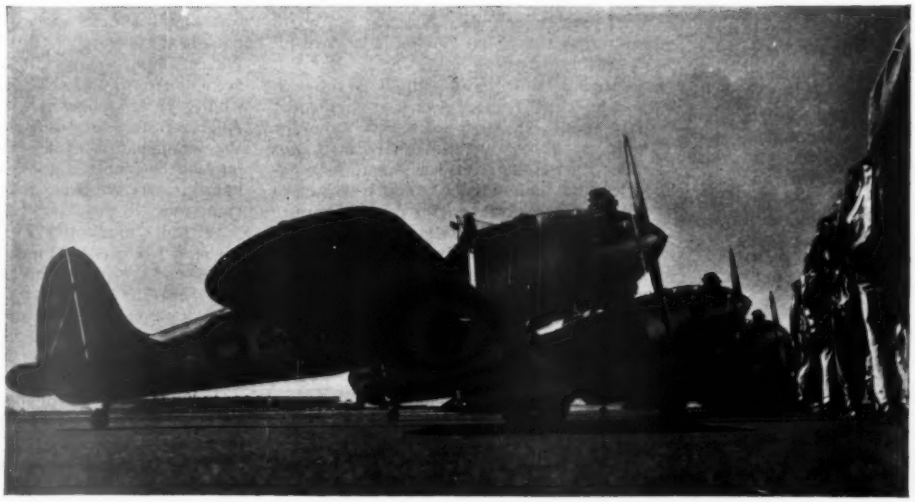

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Kinner Engines are officially serving the U. S. Army and are being installed in the famous Ryan PT-20A Primary Trainers already in military service. High performance... maneuverability and climb characterize these Kinner-powered Ryans. For sixteen years Kinner Engines have demonstrated their efficiency in training, and today they are familiar to students in more than eighty civilian flying schools in America, and to thousands of pilots now in training under the British Commonwealth Air Training Scheme.

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KINNER
AIRCRAFT ENGINES

On Guard!

(*Continued from page 41*)

station. If the government decides—should such a decision be required before the Philippines gain their independence in 1946— to defend the islands against aggression, PBY's will be concentrated at Cavite for all-important missions. A glance at the map shows that Yokahama lies almost exactly 2,000 miles northeast of that naval and air base; that teeming China far beyond the present Nationalist capital, Chungking, is inside the 2,000-mile range; that Borneo, New Guinea and other strategic islands of the East Indies are within relatively easy distance. To use an arbitrary figure, 300 giant bombers, reinforced constantly to make up for attrition, could spread a lot of havoc in this sector of the western Pacific.

In the defense of the Western Hemisphere from an attack directed from West Africa or Europe, the Canal Zone naturally would form the pivot of our long range aerial defenders. From here would operate swarms of PBY's and giant Army bombers, both capable of carrying out missions either over land or sea. The Army once stole a leaf from Navy tactics when a bombing group "intercepted" the Italian liner *Rex* hundreds of miles offshore in war games and presumably its *Flying Fortresses* could do a similar job in war.

In a parallel escape to other than its natural element the Navy's flying boats have conquered great land surfaces and could be relied on with fullest confidence in a job of observation somewhere over Brazil, Bolivia, Peru, Colombia, Ecuador or Venezuela. For the PBY radius from Coco Solo, Canal Zone, extends 20° below the Equator and encompasses almost one-third of the South American continent whose security has become integrated with our own national defense. Central America is virtually a "front lawn" for these ships which can vault from Panama almost to the Rio Grande.

In their more direct function of implementing the fleet, the Canal Zone's PBY's would have a busy task—one they unquestionably already have performed many times—patrolling the island-studded Caribbean, that alluring sea in which the destiny of the western democracies, resting on naval power, may yet be settled. A steel jaw of patrol bombers can yawn protectingly over the Caribbean with fullest development of the Navy's infant base at San Juan, Puerto Rico; at Guantanamo Bay, Cuba, and in the Virgin Islands, whose major port, St. Thomas, was the terminus of the longest one-way, non-stop, over-water hop in the history of seaplanes. This was accomplished by a demilitarized version of the PBY, Richard Archbold's famed *Guba*, which hummed unconcernedly over 3,300 miles of the Atlantic from Dakar, French West Africa, in June, 1939. Look at the map again and you will realize why all this attention must be paid the Caribbean which can be *such* a broad avenue to the Canal Zone for a powerful naval force.

Moving into the North Atlantic area proper, patrol bomber squadrons flying out of Norfolk, Va., today comprise its major long range scouting air guardians. But other East Coast sites, such as at Jacksonville, Fla., undoubtedly would be equipped with full seaplane facilities in a future emergency. And should the time ever come when collaboration with Great Britain becomes the lot of our Navy, Botwood, Newfoundland, looking almost directly across the turbulent Atlantic to Ireland, would be no stranger to the PBY-type. For it was here that one of these craft, sold to the Royal Air Force, paused before the Archbold *Guba* crew, commissioned for the job, resumed the delivery trip with a non-stop jaunt to Felixstowe, England, in July, 1939. From here also American Export Airlines conducted survey hops to Marseilles, France, with a commercial adaptation of the PBY.

Neither rain nor heat shall stop these swift couriers of destruction—nor shall cold and fog and bitter wind. Functions of Uncle Sam's patrol bombers must be carried out in tropical regions, in temperate zones and in the gnawing frigidity of the Pacific Northwest where the initial defense of Alaska and the Aleutian Islands has been given over almost entirely to their broad wings. Squadrons have been operating out of Seattle, Wash., Sitka, Alaska, and Kodiak Island, Gulf of Alaska, in recent years, getting accustomed to the difficult flying conditions, studying the corrugated topography of the Alaskan coastline, learning locations of desirable landing places for an invader.

The United States and Russia are next door neighbors in the Far North. The imaginary boundary line between Alaska and Siberia virtually bisects Bering Strait, passing between two islands that may some day suddenly assume tremendous significance. Today they're known as Big and Little Diomede—Big on the western or Russian side of the "border" separated from Little by a narrow channel. Only four miles apart, on days when the Bering Sea fog is cast aside, privacy probably is hard to attain. Hence, when whites and Eskimos on Little Diomede, merely with the use of binoculars, noted Russian soldiers and activity that appeared like the construction of a large airplane hangar at Big Diomede, Uncle Sam perked his ears. Of course it is likely that the story, revealed by the crew of the Coast Guard cutter *Perseus* on its return to San Diego from the annual Bering Sea patrol this summer, already may have been told Uncle Sam by his ever-watchful sentinels, the patrol squadrons of Sitka and Kodiak. Nevertheless, even if the Big Diomede account is pure imagination, the mere possibility of a foreign base four miles from American territory is reason enough for the maintenance of a strong air arm at our northernmost bastions—and the Alaskan outposts are being expanded posthaste right now.

With its maximum 2,000-mile one-way range, a Kodiak-based unit can "see" to the fringes of the Arctic Circle and deeply into the Siberian cold shoulder pointed at Alaska. All the Aleutians lie within its radius. From Sitka and Seattle the entire Canadian west coast can be scanned.

The rugged, all-weather characteristics of the Navy's patrol bombers probably have been demonstrated more dramatically than any other seaplane in the world. Archbold's use of the *Guba* in numerous take-offs and landings from a two-mile high lake in Netherlands New Guinea, and later in the epochal non-stop crossing of Australia, the spanning of the Indian Ocean, Africa and the Atlantic near the Equator, proved to the Navy that its patrol aircraft can take hot weather punishment.

Sir Hubert Wilkins employed a PBY type—commercial designation Model 28—purchased from Archbold three years ago to hunt for Levanevsky, the Russian flyer, and his mates missing on an attempted transpolar flight from the U.S.S.R. to the United States. The ship flew 19,000 miles, mostly over frozen wastelands in the vast stretches of central and northern Canada and over sub-arctic islands almost forgotten by man. Of all the missions ever undertaken by a PBY, this was perhaps the most illuminating to our service fliers who learned how a 13-ton craft can almost skim across tundra at low altitudes in the hope of finding the answer to an aviation mystery, make improvised landings and take-offs on Canada's numerous lakes, withstand a terrific ordeal fraught with the peculiar hazards of flying in low temperatures—all in a region where servicing facilities are absent. In hot or cold this ship is ready.

Our patrol squadrons could cover the skies from the Arctic to 20° below the Equator given the necessary numerical strength. From the mid-Atlantic on the

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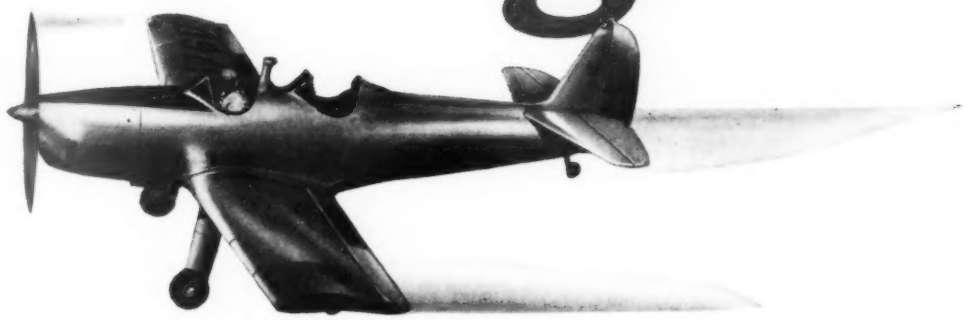

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The Vega 35 offers training schools excellent serviceability and features never before found in *one* airplane. Students learn the *right* form... right from the start of their training. Excellent visibility with in-line engines...perfected stall control characteristics... wide tread landing gear with individually controlled brakes...and wing flaps for low landing speed. Such features simplify the job of the instructor and inspire confidence in the student.

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MARCH ISSUE

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east to Burma in the Orient, the Navy can, thanks to its patrol bombers, obtain vital information should future contingencies require such wide roving. More hundreds, more thousands will be needed, but the sturdy nucleus is already there, unpretentiously performing what today seems a humble task, gathering data that tomorrow may become priceless.

END

The CPTP . . . ?

(Continued from page 58)

the instruction in the CPTP is inferior to that in the services and that the lightplanes flown in the first half of the course do not give adequate experience.

On the other hand, at the 18 big schools under contract with the Army to handle its primary course, are working 500 instructors turned out by the CAB refresher course. It is difficult to see if 500 CAB instructor-graduates who are working for the Army are satisfactory, why most of the remainder, allowing for individual exceptions, are not as good. Most of the 18 schools also run a CAB course.

Army trainers weigh between 2,000 and 3,500 pounds. Their horsepower varies from about 125 to 450. The combination of plane and engine is always such that there is plenty of horsepower for weight of plane carried and there is enough power to assure top speed of at least 125 m.p.h. The *Cub* trainers used in the first part of the CPTP weigh 1,000 pounds and may have engines with horsepower from 45 to 65. Their top speed is from 90 to 110 m.p.h.

The Army feels that, in preparation for high-powered pursuit ships or four-motored bombers, their flyers should learn behind fairly heavy motors such as those described above. This theory is at variance, however, with the practice of the British R.A.F. and the Nazi *Luftwaffe*. The *Luftwaffe*, as is well known, makes extensive use of gliders as an introduction to flying powered aircraft. The R.A.F. starts its pilots out on de Havilland *Tiger Moths*. The *Tiger Moth*, although it grosses 1,825 pounds, is fundamentally a light biplane, since its wing loading is 7.6 pounds per square foot—a considerably lighter loading than that of the U. S. Army primary trainers and almost in the same class as the *Cub*. Its power loading is also light, a 130 h.p. engine giving this little biplane a top speed under 100 m.p.h.

The reason for the use of gliders and lightplanes abroad is the feeling there that the way to teach a man how wings behave is to let him ride a pair of wings not blotted out by a powerful engine. R.A.F. people have pointed out, for example, that there are plenty of times when a combat pilot will suddenly find himself without an engine that works.

As this is written, one of two possible lines of new development seems likely. Either the CPTP will be reduced, maybe to the point of its discontinuance, or it will be carried on in closer cooperation with, or under the control of the Army and Navy. If the second course of development is followed, advanced students will be placed directly under the Army and Navy air services. The Army will then be able to follow its practice, developed in the draft regulations, of allowing students to finish their college courses before going to training camp.

This would seem to be a much cheaper method of giving primary training than that now employed. By feeding and housing themselves during the primary period, students will be saving public funds. Army primary training costs about $30 an hour per student as given in the past at Brooks Field. As given in the contracting civilian schools, it is reduced to $18 an hour. CPTP costs are even lower. A considerable saving over the present method should be possible, even if CPTP students need extra time for checking out in heavier planes.

Evolution of the program along the second line would mean the success of the "guinea pig" classes. Some Navy officers (but others disagree) already feel that the CPTP is justified. They feel that the Navy can put to good use whatever the CPTP student has learned and make an overall saving of Government money. The Navy program is particularly well-adapted to making use of any previous experience of their flying cadets. This is because it is broken up into short stages and a student can be started at whatever point he qualifies for. It is felt by several Naval airmen that the average CPTP product will fit far enough along in the Navy's course to save the Navy more money than was spent on him.

Whatever becomes of the CAB training program, purely private flying may have to take a back seat for the time being. This may go beyond the training program and into other fields of civilian air activity. Certain hardships will necessarily be suffered in the process.

Putting the CPTP under the direct control of the armed services will disqualify those not otherwise eligible for the Army and Navy from receiving training at Government expense. The two large groups obviously thus eliminated will be women and Negroes. About one-sixteenth of the present CAB students are women. The number of women pilots has risen by nearly 100 per cent in the last year. Major credit for this must be given to the CAB. Hundreds of Negroes have also taken advantage of CPTP courses at Negro colleges and others. Others who will be affected, unless the Air Corps changes its present educational requirements, will be those in the non-college courses.

Lightplane manufacturers will be affected if the CPTP is dropped. The phenomenal growth in their business in the last two years is traceable in large part to the program Bob Hinckley helped to put over. Small field operators may find themselves once more in the doldrums of the 'twenties and early 'thirties, for a direct Army and Navy program would probably never be so widely dispersed as the CPTP.

Sweeping as are the changes outlined in this article, more sweeping ones still may be in store for flying generally. The pace with which the U. S. aviation picture is changing is so rapid that it is scarcely possible any longer to look more than a few weeks ahead, let alone six months or a year.

END

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The Negro is Flying

(Continued from page 34)

highest grades reported on Civil Air Regulations, meteorology, and navigation tests in the 1939-40 group. Alexander Anderson scored 100 on Civil Air Regulations and 92 on navigation and meteorology. Charley Foxx averaged 97 on the two examinations.

Foxx later was honored by being chosen one of the seven private licensed pilots trained in the 1939-40 program to represent Region II (North Carolina, South Carolina, Tennessee, Mississippi, Georgia, Florida and Alabama) in a contest conducted by the Institute of Aeronautical Sciences. The Shell Petroleum Company offered funds to conduct the contest and to award the winner $1,500. Because of a conflict in date of the contest with date of an appearance on a Tuskegee financial campaign program, Foxx was unable to enter. For his decision to remain on the school's program, Foxx was commended by the Institute of Aeronautical Sciences for his "loyalty and sense of duty."

Anderson is being encouraged by Director Washington and other instructors in the department of mechanical industries in working out ideas of an inventive nature on parachutes. He hopes to develop parachute jumping and inventive work in that connection as a vocation.

Most of the students of the first flight program entered school for the succeeding terms. Six from the primary classes enrolled in two of the advanced training programs and three in the apprentice instructors program. The graduates of the flying classes and those still receiving instruction are enthusiastic about flying and are seriously impressed with the importance of their instruction in this time of national emergency, according to Washington.

The CAA recently announced: "All Negro students now receiving flight instruction are required to pledge their willingness to enter military service, if qualified and will be called upon the same as white students in the CPT program. The method of selection of these Negro flyers will be determined by the War Department. Thus far no plan has been announced."

Washington's view on the Negro's place in aviation is: "The trainees are interested and enthusiastic regarding aviation mechanics' training, which we are all hoping will develop following realization of our own air field at which the training facilities in mechanics would be located. Every mechanic and technician should know how to fly. Many leading schools require that aeronautical engineers, mechanics, technicians and others concerned in this work do 20 hours of flight in order that they might better perform their jobs.

"Thus flying is the logical forerunner of the training of aviation mechanics. To maintain 50,000 planes for national defense there will be needed at least 150,000 pilots and 150,000 mechanics or service men. This is exclusive of the needs of commercial operators and service of private planes. There is indeed a field for the Negro in aviation mechanics.

"America never has had occasion to question the loyalty of the American Negro. In such important service in our defense mechanism it would seem that qualified Negroes would be encouraged to train themselves for such service."

Washington believes also that flying has rich recreational possibilities for the Negro, but that his chance in Government or commercial flying is small. There is not the racial resistance to Negro mechanics that there is to pilots, he believes. A scarcity of Negro flight instructors, foreseen at Tuskegee, may provide occupation for some students who have completed the advanced flying courses and continue their training until they receive their instructors certificates.

The problem of providing adequate field and hangar facilities was attacked with vigor as the 1940-41 school term opened and was carried on as a campaign into this year. A leased field, very small, was re-conditioned by the students themselves at a cost of not much more than $1,000. This served the primary flight courses and some of the advanced training groups, but was not entirely adequate for the aviation program of the school. Hangars were erected to house the *Cubs* and one Waco. The other Wacos were kept at the landing area at Auburn, 40 miles from Tuskegee. Here flight training in the refresher course, in the apprentice instructors' course and in part of the secondary courses was given. This proved as unsatisfactory as the arrangement whereby the first primary students drove to and from Montgomery, Washington said. Here was another demand that Tuskegee have its own airport.

Alumni began a drive in September to raise $30,000 toward constructing an airport on the campus and were almost prepared to make a successful report on their campaign a short time ago. President Patterson announced that trustees of the Institute agreed to appropriate $8,000 to supplement the fund sought by the alumni. Sites for two half-mile runways near the administration buildings were approved by the Alabama Aviation Commission. Patterson said the possibility of requesting a WPA or PWA grant to construct the airport had been discussed with Government officials, but application was withheld because of a Government ruling that the land must be deeded from the school, (which is privately owned) to the county or state.

Patterson and Washington, meanwhile, conferred with officials of the national defense council in Washington early this year with the view of obtaining a national defense project in the training of aviation mechanics or other types of mechanical specialists needed in the defense program.

A permanent organization to give private instruction in aviation through establishment of a department of aviation is an aim of Patterson and Washington.

"Scores of persons have applied to Tuskegee for flight training. Inquiries have come from more than 20 states. From this you can gather some of the importance of our establishing a permanent aviation department and construction of

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our own airport and maintenance of a staff of instructors for this purpose," Washington said. "I am pleased to be able to announce that we will have the beginning of such an organization in operation by the fall term of 1941," he stated.

A few private students were being trained at Tuskegee early this year, but the number was limited to a very few because the school's facilities were already taxed by the Government program.

In describing plans for the private flying department, Washington pointed out that the warm, clear weather in southern Alabama makes flying possible almost every day and pointed to this as a great natural advantage to Tuskegee in developing an aviation center. Furthermore the flat land requires very little grading to construct an adequate landing area and presents none of the hazards of flight over mountainous terrain. Similar latitudinal locations have been chosen by the Army and Navy in expanding and building new air bases.

END

Stall and Turn

(*Continued from page* 46)

tain our altitude and we attempt to "tighten" the turn by the addition of more back pressure, we will do one of two things: enter a climbing turn, or stall. If we wish to shorten our radius of turn, we can either increase our degree of bank (and if we maintain altitude, we will have to also increase our pressure to the rear on the stick at the same time), or if our speed range permits, decrease our power and speed. (If we decrease our power and speed, we will then need more pressure on our stick to maintain altitude.)

It is also apparent that it is impossible, with any conventional airplane, to do a "vertical bank." In the position that it would be necessary to assume in order to do a vertical bank there is no force available to offset the pull of gravity, unless we use our fuselage as an airfoil and purposely fly the aircraft on its side. If we do this, we are slipping (skidding toward the low wing), because the airflow is no longer straight over our wings and parallel to our longitudinal axis. (It is perhaps possible to fly some aircraft in the vertical position, or rather on their side and maintain altitude, but such an airplane would probably have a very low power loading.) Centrifugal force will *never* help us to maintain our altitude in a *turn*, although it does help to some extent in a loop or steep chandelle.

To repeat for emphasis, we can see that we only use our rudder (neglecting the effect of torque) to offset the yaw caused by use of the ailerons in smooth air, or to offset the yaw caused by turbulent air conditions or any yaw caused by a combination of use of the ailerons and turbulent air. We must use the rudder *whenever* we use the ailerons during elementary student instruction and only when we use the ailerons.

We might also add that, in the fully loaded light aircraft powered with an engine of 50 h.p. or less, a bank of approximately 50° is the maximum bank possible without loss of altitude.

Now that we understand more clearly the basis of a good turn, it is equally important that we understand how to make that turn safely. In order to do this we must be familiar with the study and practice of stalls. Competence in this maneuver added to that in turns enables the pilot to make safely all climbing and gliding maneuvers, steep turns, landings.

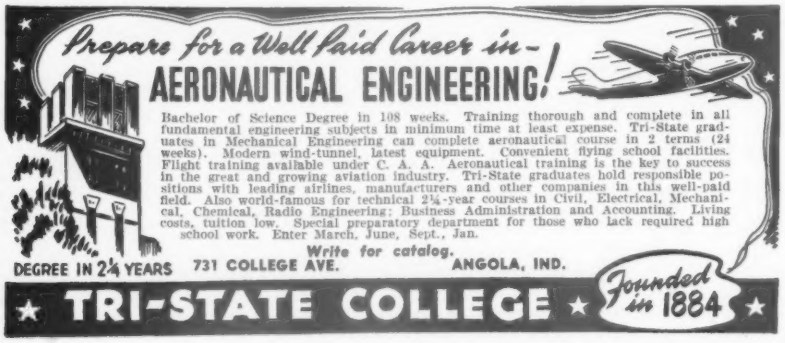
For the sake of clarity it is necessary to divide stalls into three general types: (1) the approach to the stall, (2) the complete stall and (3) the advanced stall. Each of these three general types of stalls may be further divided into power-on and power-off stalls. Stalls may be still further classed as those done in various types to turns: climbing, gliding and steep.

In other words, to fully designate the maneuver desired, it is not sufficient to merely say to the student "do a stall." This statement is too vague. But to say "approach a stall power-on, straight ahead," or "do a complete stall in a steep turn to the right" leaves no doubt as to the maneuver desired.

We hope that the student will learn two things from his instruction and practice in stalls: (1) to recognize the approaching stall in various positions of flight, and (2) to instantly apply the proper correction to remedy this condition. If the student is competent to do these two things he will never "spin in" unless he completely loses his head.

The *complete stall* might be named the elementary stall. In this maneuver, the student is required to completely stall the aircraft by use of the elevators and immediately recover by application of forward pressure, or relaxation of backward pressure on the stick or wheel. The controls are used normally up to the point where the student recognizes the stalled condition, but the recovery is normally made with the ailerons and rudder in neutral.

The *approach to the stall* might be named the secondary stall and is probably the most important stall of the three general types. To execute this stall the aircraft is slowed down, by use of the elevators, until it is on the verge of completely stalling and recovery is immediately initiated at this point, almost always by *relaxation* or the backward pressure on the stick, rather than by forward pressure on the stick as is sometimes necessary during instruction in complete stalls for the sake of emphasis during a proper recovery. Again all of the controls are used normally until the moment recov-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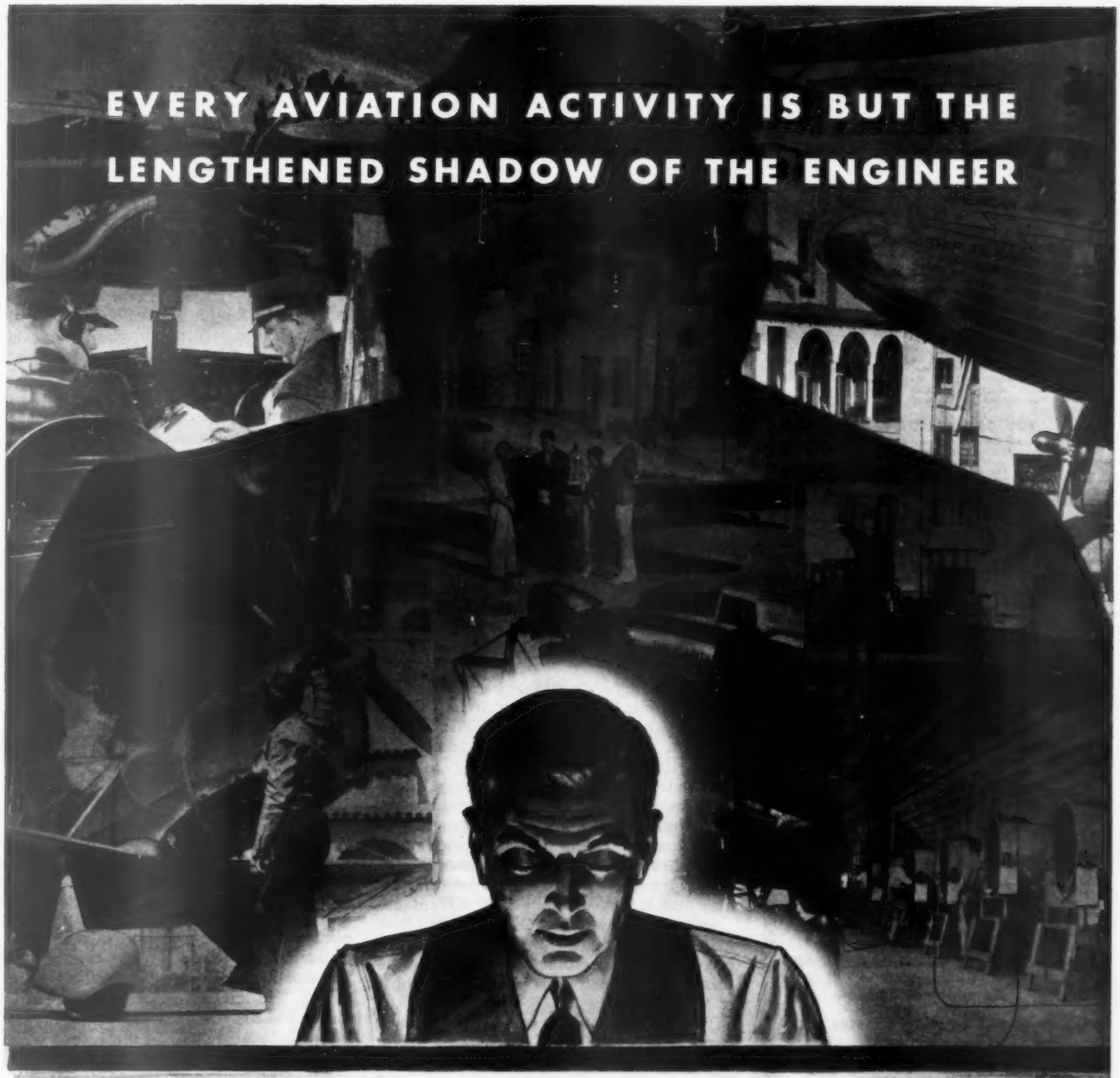

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ery is initiated. During recovery the aileron and rudder should be in neutral or, at least, should not be used.

The *advanced stall* has no place in primary instruction. It may be demonstrated to the student, if for some reason the instructor deems this advisable. The advanced stall is a maneuver in which the aircraft is completely stalled, the stick is brought to its full rearward position and the flight path is controlled with the rudder, usually in a straight line. The ailerons should *not* be used. This stall can be said to be the basis of a number of aerobatic maneuvers. With slight changes of timing in the use of the elevators and rudder, this maneuver can be made into a falling leaf, snap roll, vertical reverse or spin.

The instructor should realize that the student learns to recognize stalls in three ways: visually, aurally and by muscular reaction, commonly called "feel." He must learn to take heed to the warning of these three senses and make automatic his recovery or correction of the stalled condition.

Regardless of speed, an airfoil stalls at only one angle of attack, so the proper way to correct a stalled condition is to reduce the angle of attack and this is almost invariably attended by an increase in speed. In simple words, get the stick forward, usually by relaxing the "back pressure."

The instructor should be careful that he does nothing to hamper the student while he is learning stalls. The slightest pressure on the controls by the instructor when the student is practicing a stall, eliminates the use of the student's "feel" in recognizing the stall. Too much conversation during the student's practice of stalls hampers his aural perceptions and hand signals during the maneuver should be kept to a minimum in order that he may use his eyes to the best advantage.

In closing it will be well to mention that excessive speed should not be built up in recoveries from either stalls or spins, as this may overload the ship past the point of safety.

The instructor who can bring his students to a high state of proficiency in the execution of turns and stalls, will have no reason to "chew his nails" at the time of the inspector's visit.

END

Littlest Line

(Continued from page 28)

man was D. M. Renton, vice president and general manager of the Santa Catalina Island Company.

"We need a chief pilot," Renton said, finally. "How's about it?"

"I'll try it for a month," Seiler said.

The month has stretched almost to 10 years and should have a lot of elastic in it yet, now that new excitements and new problems are coming up.

Seiler is a bit shy about off-schedule operations. He, like most of the old-timers with thousands of hours under their belts, doesn't "pop off" about thrilling experiences. Once he said:

"We never operated nights — except once—"

We followed this thin lead:

It was 3:30 a.m. on a cold January morning in 1932. The late William Wrigley, Jr., was seriously ill at his Arizona home. Seiler piled out of bed, got Hill, trundled out an amphibian, warmed it, roared over to Glendale, lowered his wheels, picked up a specialist and turned his ship east to Phoenix. He got there after daylight and, according to his story, "pretty soon Mr. Wrigley felt better."

Another one:

It was late in 1931. The steamer *Colombia*, owned by the Panama Mail Lines, had struck a reef off Baja, California, 650 miles south. It was breaking up fast. In a safe in the hold was gold amounting to $850,000 destined for San Francisco banks. They couldn't get the safe open. Would somebody please fly down a load of dynamite? Seiler did; they got the gold.

And still another:

Wires and radio shrieked the news that two Navy pilots had crashed off the southern tip of the island. Seiler went out in an amphibian. He found one pilot injured seriously, the other shaken up. He got them aboard, rushed them to a hospital on the mainland. Both recovered.

"We got credit for saving their lives," he says.

Then there was the time he raced up to the Isthmus where a boat had just exploded. He helped get the burned men into the amphibian and flew them to the mainland, where he helped load them into an ambulance.

"One died," he says. "We were too late."

There are a lot more stories. The one about the three-day-old baby who had to be rushed to the specialist on the mainland, who had to be rushed back three days later. Seiler did both jobs. And when it comes to childbirth, heart attack cases, appendectomies and other ailments to which all mortals are heir, Seiler refuses to give any kind of an estimate on the number of lives the line has saved. He tells, too, of ships of all kinds sighted in distress in the channel, of telephone calls at the end of those runs which have saved plenty of people.

"That's why I say," he points out, "that the airline's a service. Profit and loss doesn't count."

Seiler, balding, is slim and straight as an arrow, keeps that Navy stance. In spite of all his experience, he's still on the sunny side of 50. He's married, has a 15-year-old daughter. His wife and daughter have to live in Glendale. Because of the press of work, he has to spend a lot of time at Catalina. He has quarters in Bachelor Hall, the famous home of the late Zane Gray, novelist. He's a Quiet Birdman, has logged 6,000 hours and is a member of the Pacific Aviation Club.

Right now, he's planning to get the name, Wilmington-Catalina Airline, changed to plain Catalina Airline [this recently was done—Ed.], mainly because it won't run to Wilmington any more. He's like a skipper abandoning ship with those Douglas *Dolphins*, which he calls the greatest amphibians ever made. He doesn't know yet what'll happen to them.

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But he's looking forward, too, to abandoning 125 m.p.h. and taking on 234 m.p.h—and seeing more of his family in Glendale.

"Going twice as fast over a line twice as long," he says, "is really something."

END

Hero from Winona

(*Continued from page* 36)

of flying. A number of years ago he played the banjo with a dance orchestra traveling the middle west. He also played the cello and piano. Now he will spend hours during an evening playing the piano as relaxation.

He is a hard man to interview, as newspapermen who have visited Winona recently have discovered. Amiable, but rather reticent, he is inclined to brush off questions. He never dramatizes himself. Besides, it would be difficult to find a busier man. The reporter asks a question and Conrad starts to answer. Before he is half through, a student is hovering about with a drawing. A secretary is waiting to have a letter signed. An inspector has just landed, a breathless small boy reports. Or there is a telephone call—they won't talk to anyone else. One of the mechanics is waiting to see him. And so on.

Conrad's wife, the former Betty Biesanz, is the daughter of Charles Biesanz who was the first man in Winona to fly. In the post-war years he flew with Dick Grace. Mrs. Conrad, however, doesn't do much flying. Se is too busy taking care of the four little Conrads—Judy, Betsy, Jane and Molly, aged 8 to 3. All the children have flown and Judy and Betsy, the two eldest, have quite a few hours as passengers.

As a family, the Conrads are so air-minded that it didn't occur to them to buy a car until last summer. Conrad's "boys" take a great deal of personal interest in Max's work and he in theirs. Take a certain red-headed boy, now coming up for his instructor's rating.

"I was out of a job," he says, "when I was sent to Conrad. I told him I wanted to learn how to be an airplane mechanic. He took me up in an airplane. 'What do you want to be a mechanic for?' he said. 'You can be a flyer.'

"Well," adds the red-head with a smile, "now I have my commercial. And I didn't have a cent."

It is perhaps significant that everyone in Winona, from the smallest boy hanging about the shops to almost complete strangers, calls Conrad "Max."

His system of training is different in two ways: first, he trains his own instructors. Second, he sees that every boy who is taking a commercial course goes on at least one trip cross-country by air, to the east or west coast. Many of them have gone many times and consequently are at home in different types of airplanes and in all flying conditions.

"Unless students take long cross-country trips," he says, "they have no real picture of weather.

"On such trips the boys see for themselves how weather can be good in one place and, a little farther on, very bad. They will learn not to take chances with it. I have made so many mistakes and taken so many chances myself through sheer ignorance that I want to see that my students don't make the same errors."

The airlines, he says, season their pilots no matter how experienced they are in other fields, by making them co-pilots for a period. So, with his students, he tries to teach them how to travel competently by air from one place to another. For after all, he points out, the purpose of flying is "to get from one place to another."

On these trips the boys, usually three or four of them, fly in half-hour stretches, charting their course, studying the weather and getting acquainted with various air traffic control systems.

"They learn a lot more in one trip about navigation and meteorology than in dozens of classes," Conrad points out.

Conrad considers Gene Newman, now airport manager at Green Bay, an outstanding instructor developed by the school. Newman had 36 hours in the air when he qualified for his private license last June. In two months, he had earned his commercial license with a high rating, an instructor's rating and had been appointed manager of the airport.

Right now in Winona, the Junior Chamber of Commerce and other organizations are calling the attention of the Carnegie Foundation of New York to what the Winona *Republican-Herald* calls "the heroism of Max Conrad and Calvin Volkel (a mechanic at the airport) during the rescue of stranded duck hunters."

It was quite a feat. As one of Max's students, now an instructor, says: "It takes a swell flyer to take a plane that lands at 32 up in a 50-mile wind."

On the morning after Armistice Day, while relatives and friends of the hunters lost and trapped by the storm in the bog-lands along the Mississippi, gathered in worried groups or formed searching parties which were usually unable to find the hunters, Conrad was out at the airport getting ready for his first flight. He started about 9 a.m. and flew steadily until about six the same night, returning to the airport in his 50 h.p. *Cub* 10 or 12 times during the day to refuel. The wind varied from 30 to 50 m.p.h.

"I was sort of like a dog," Conrad says, "because I had to communicate with the rescue parties in boats without talking to them. I would locate a party of hunters and fly over them again and again to indicate to the rescue boats just where they were to be found."

At the airport they packed five-gallon gasoline cans full of sandwiches, whiskey, paper, matches and cigarettes and Conrad dropped them near the parties of hunters, many of whom had built shelters to protect themselves from the wind. Sometimes, when boats were not available, Conrad would cut his motor and come down within 10 feet of the ground and shout instructions to the stranded men.

"Follow me," he would shout through the noise of the wind, "I'll lead you out." Back and forth he went, marking the path to the hunters until they reached safe territory.

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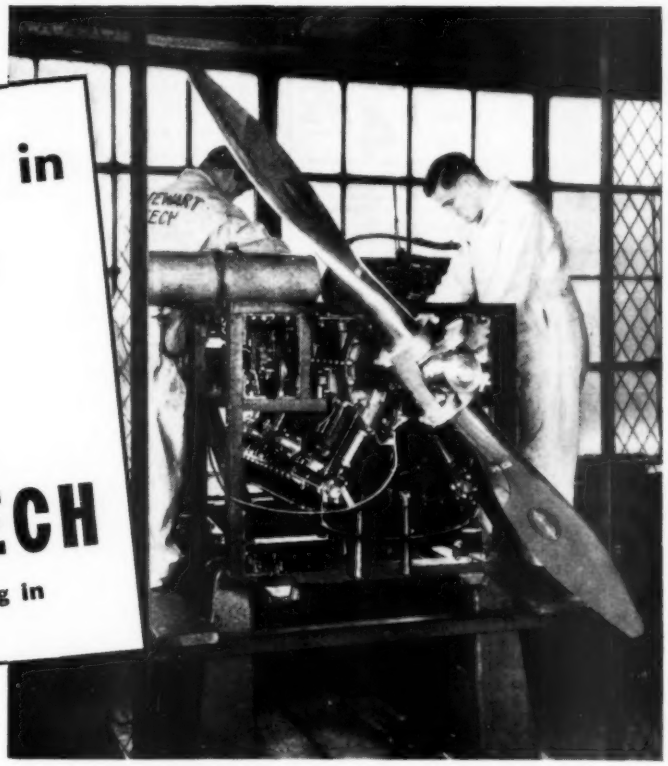

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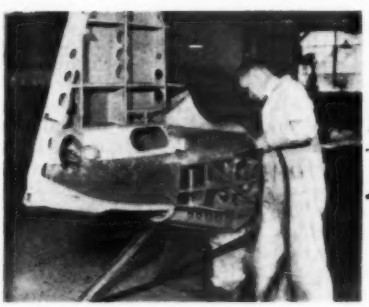

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Landing the *Cub* in the gale, says Mrs. Conrad, was worth seeing. The wind was so strong that the airplane came down almost like an elevator and, just as it touched the ground, a dozen men would spread out in the biting wind to hold the tiny ship on the ground.

Calvin Volkel is said to have saved 15 men with a rowboat, gathering so much ice on his back in the process that the heavy pilot's suit he wore split, a fact which was forcibly called to his attention when a stream of ice-water poured down his back. Conrad and his *Cub*, Winonans say, saved two or three dozen lives.

END

Want a Job?

(*Continued from page 60*)

even be called an art. In spite of the use of goggles, it is bound—over a period of time—to be hard on the eyes. We, personally, would not like to be a welder; and we would particularly not like to be an arc welder. This, in spite of the fact that the wages paid for such work are almost double those which are paid for semi-skilled mechanical work.

Some factories employ electric arc welders who are known as "non-aircraft welders." These men are used to electric-arc-weld the various units of jigs and tools and for general maintenance work. They do not require the Army and Navy classifications—but they are paid somewhat less than aircraft welders. Aluminum welders are particularly hard to find. The ideal combination of crafts for a welder is, of course, gas, arc and aluminum welder. Such men generally draw the highest mechanics' wages in the aircraft industry—if they are really good at all three branches of the craft. This is because they can be put to any job of welding and are not subject to the layoffs that may result from the scarcity of work in a specific welding medium.

* * *

Here's a note for the men who have written in asking for information about the possibilities for employment in the lightplane industry. The basic manufacturing problems of the lightplane industry are not too different from those of the heavy plane industry. Both manufacturers have to cope with the same procurement, assembly, and inspection problems for example. The structure of most lightplanes, however, requires a rather different type of mechanical labor than does the structure of the all-metal ships that are used by the airlines and the various branches of the military services. With the exception of the Luscombe and a few other light ships, most of them are built up out of welded steel tubing which is fabric-covered. Gas or arc welders who are qualified to do aircraft welding on chrome moly steel tubing are naturally in demand. Sheet metal workers, on the contrary, have relatively little place in the lightplane industry. Since the stabilizers, control surfaces and wings are almost always fabric-covered, skilled coverers are in demand. This may be a tip for the ladies. Also, a greater percentage of dopers will be employed. Aside from that, there is not much we can give you. We wrote a number of letters to the employment managers of various lightplane manufacturers and came up with the above information. What we would earnestly suggest is that if you are skilled in any craft you feel might qualify you for the building of lightplanes, you write some of the advertisers in FLYING AND POPULAR AVIATION. Write their employment offices, telling them that you live nearby and are going to make a trip to their city in the near future. Quite possibly you may develop something. The lightplane business is booming these days. We flew a Stinson "105" not long ago, and are now trying to figure out how to pay for one.

Next month we'll go into some of the wierder branches of the industry we've been asked about—and also try to give you a list of airline jobs, with basic qualifications for each.

P.S. Three or four men who are in the Army Air Corps asked what their chances were of getting a job when they get out. The answer is—excellent! Time after time, we have seen ex-non-coms from the Army, and Naval petty officers walk into the employment offices of the major manufacturers on the Pacific Coast. In every instance they were given a hearing and, in most cases, they were given jobs. Both services seem to train their personnel the way employers like them trained. It may be specialized proficiency in one type of work only, but men who have had Army or Navy training also pick up enough knowledge of the other maintenance and flight branches of the two air services to be of value to almost any employer. Under the present set-up, we do not think service men should worry too much about jobs. Particularly, since the industry as a whole is on a dead hunt for skilled and experienced personnel. About six months before they get out of the service such men should start firing letters at the most easily accessible company which is engaged in the type of work they are interested in, explaining their circumstances and asking for employment. A letter from their commanding officers should help. END

Aircraft Radiators

(*Continued from page 55*)

Generally the worst condition is at 3,000 feet altitude. There is not only a drop in temperature with increase of altitude but also a drop of the boiling point of the water. A chart in Section 5 indicates the boiling point of the water at various altitudes. The relative size of radiators needed for various altitudes calculated for the average temperature is plotted in the upper chart in Section 6. The lower chart in Section 6 is of great interest, for it shows the increase of cooling efficiency of a honeycomb radiator inclined to the airstream. The resistance, however, increases with a greater amount.

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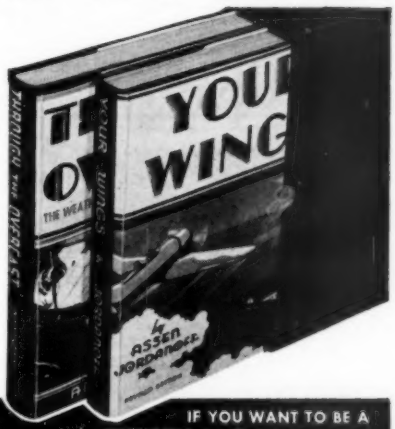

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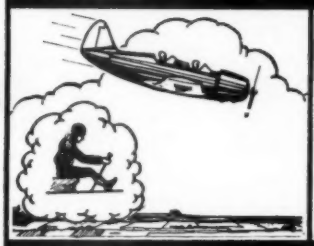

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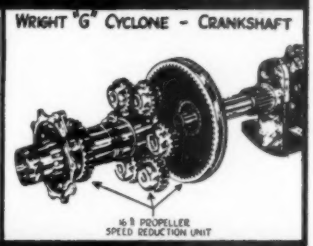

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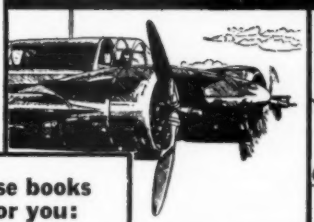

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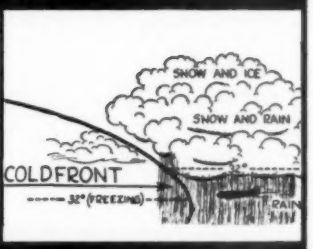

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ways reason to favor air-cooled engines. In the early days of flying, when two to three minute flights were record flights, engines were cooled by adding a small water tank above the engine, as sketched in Section 7. The Wright Brothers used a flat tubular radiator of high efficiency as shown in Section 8. Then came the era of large honeycomb radiators. The famous pusher biplanes used one large center radiator of two to three inch depth. To prevent blanketing by the pilot two radiators were used, as shown in Section 8. The low speed was the cause of the size of the radiators. With the design of tractors came the nose radiators. The nose radiator, quite contrary to the appearance of perfect streamlining, increased the resistance with an excessive amount and the streamlining of the fuselage destroyed. The radiators were placed in the wing or on the wing. Surface radiators were placed on the side of the fuselage or on high speed racers on the floats (Section 9).

Wing surface radiators (Section 10) soon were discarded for it had been found that the increase in cooling efficiency also decreased the efficiency of the wing. Radiators then were placed below the engine, as sketched in Section 11. The depth of the radiator was increased in order to insure small frontal area, for the drag of the radiator had greater influence on the top speed of a high-powered plane than its weight. Radiators are generally equipped with shutters (Section 11) in order to control the temperature of the cooling water. Shutters must cover the whole radiator block. If part of the tube-block is exposed there is danger of freezing. Temperature also may be regulated by by-passing some of the water flow. The danger of this system is also the freezing of the water in the core.

Today radiators are submerged into the fuselage or wing. To increase their efficiencies they are made retractable. Retractable radiators were used in 1918 on the U.S.D: 9, as sketched in Section 12.

The efficiency of a radiator is expressed by its figure of merit. This figure is the ratio of the heat dissipation and the air resistance expressed in term of horsepower. The absorbed horsepower is estimated for an airplane flying at a lift-drag ratio of 5.4 and the horsepower required to overcome the drag. A chart in Section 14 gives the figures of merit for a four inch deep and a nine inch deep honeycomb radiator; the dotted line is plotted for a wing radiator.

The test results indicate that radiators have higher efficiencies at lower speeds. This was the reason, years ago, for placing the radiator outside of the slipstream of the propeller. The same reason we find in submerging the radiator into the fuselage for high speed planes. A small opening allows the entry of the air at high velocity, which then is reduced to the most efficient speed for cooling. After passing through the radiator, the air moves through a duct reduced to its original size, increasing its speed to the velocity on the outside.

Data are given in Section 15 to estimate the weight of a radiator. In the same section a formula gives the reserve water required for longer flights. All above mentioned formulas are given for water-cooled Ethylene glycol now is used for a cooling liquid, especially for high-speed planes. This fluid boils at 387° which adds about 150° to the temperature difference in determining the size of the radiator. Consequently it also adds to the output of the engine, which may amount to five per cent. A glycol-cooled radiator should be only 40 per cent of that of a water-cooled one.

In 1909 cooling of airplane engines was tried with steam. The heat contents of evaporation is so great that only a very small amount of water is required for cooling. The condenser, however, is so large that its weight would be prohibitive for use in an airplane. There also are notes that for record runs dry-ice (solidified carbon dioxide) was used. Exact data are not available.

Liquid-cooled engines, especially the inline engines, have seemingly less frontal resistance. There should be no reason why air-cooled engines should not give higher speeds than liquid cooled if properly cowled. It would not be even very new for in 1908 the firm of Renault placed a twin-eight inline engine, cowled, on the market, which performed satisfactorily. The competition between the air-cooled and water-cooled engine designers will go on.

END

I Learned About . . .

(*Continued from page 37*)

northwest wind with severe gusts and it was real work to keep any symmetry in the formation of tiny single-seaters even at 6,000 feet, where we climbed seeking smooth air. Nevertheless, the show went off perfectly until we went into our stack for the finale. We formed stack with difficulty, as the ships were bucking badly in the turbulent air and several times I wondered, from my precarious position in the third "layer" of this flying birthday cake, why I didn't get conked on the head with Number 2's (the ship next above me) landing gear or propeller tips. They told us later that it looked very precise from the ground, but then altitude cures a great many sins in tight formation-flight—at least from the spectators' angle.

Finally we got spaced and placed to suit Sandy's experienced eye and the dive signal flickered down the ailerons of the tight little group of fighters. The controls became harder and the roar of the bunched motors reached a splitting screech as we gained speed, each bounding bump of the rough air in which we flew becoming more violent as our speed increased. I never knew what our dive-speed got to during that dive, as I was working with aching arms trying to keep Number 2's prop out of my scalp and holding my ship steady as possible in that rotten air to avoid embarrassing Number 4 (directly under my seat about 20 feet, I *hoped)* and the others below him. We must have hit 240, however and, in those days of light-wing-loaded pursuits, 240 was quite a gait in rough air.

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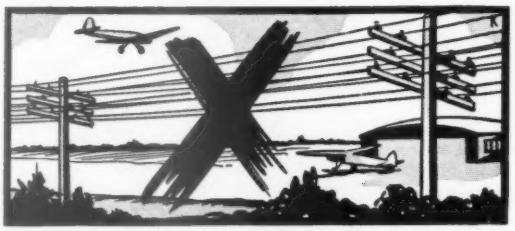

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After what seemed an endless, muscle-tiring eternity of this chaotic dive, I saw Number 1 peel off and up, into the blue sky, Number 2 following three seconds thereafter. Came my turn to follow and I eased my plane upwards and over the loop, keeping Number 2 between my cabane struts as I reached the top, as was our method to avoid flying through the prop wash of the preceding planes in the circuit.

I can remember looking back over my head and downward toward the green Ohio prairie as I went over the top. Sandy had, as usual, stretched his first loop a little bit at the top to allow entry-room for the following ships and, in order to cooperate with him and Number 2, I had to fly flat upside down for a few seconds. This gave me my daily face-wash of 80 octane gasoline mixed with a few drops of engine oil, but having learned to inhale and digest this mixture during weeks of practice, it didn't bother me too much.

I looked backward again as I slid down the off side of the loop and saw all the other ships in their proper places around the loop, with Sandy just about to reach the top of his second one. Everything was "jake" now and we continued this chase for several minutes, alternately gulping gas at the tops and momentarily "blacking out" at the bottoms of the loops.

Since we were necessarily losing some altitude we soon ran into some of the worst turbulent air I'd ever flown in. We must have gone around 10 or 12 loops when, as I happened to be looking at Sandy's ship, I saw it get blown out of line just enough to put him in Number 9's prop wash. His ship did a reeling flipflop, rolled onto its side, then back again and started to spin downward, *upside down*.

Fascinated, still rounding the top of the same loop myself, I watched him as my ship ploughed by his, both of us on our backs, though he was out of control. It was necessary that I stay in position and I had to watch Number 2, though I wanted so badly to see how Sandy was making out. As I came down the off side again, I saw him working to recover from an upside down flat spin. He finally got over onto his belly in recovery, but the resulting dive was in such a position that he dove right through the wings of Oscar Brice's Number 7, and both ships disintegrated instantaneously at the bottom of our squirrel cage.

By this time I was diving at around 250 m.p.h. but, as pieces of cowling and other miscellaneous parts came whizzing by my ship, I pulled out and over to the side at full throttle and climbed into the biggest stretch of blue sky that I could find unsullied with bits of broken airplanes. When I was in the clear again and had gotten my heart down below my tonsils sufficiently, I looked over the side with apprehension. Was I tickled to see two of the nicest, whitest parachutes in full bloom down there, with both pilots okay!

I learned about slipstreams from that!

END

Fearless Soldier

THE War Department recently awarded the Distinguished Flying Cross to Private Raymond U. Whitney of Wright Field for his dangerous but successful work as an experimental subject in carrying out medical research studies for high altitude flight. During the time Private Whitney, a native of Chardon, O., has been assigned to the Aero Medical Research Laboratory at Wright Field, a long series of experimental studies has been conducted to determine the limits of human endurance in flight. The experiments included the maximum altitude to which one can go while breathing oxygen; the effect of rapid rates of atmospheric pressure decrease equivalent to ascent from sea level to 30,000 feet, during which rates of climb up to 12,000 feet per minute were attained; the effect of rapid rates of pressure increase equivalent to descent from 30,000 feet to sea level, during which rates up to 30,000 feet per minute were attained; the effect of prolonged exposures from 25,000 to 35,000 feet altitude pressure; and flight tests of the Lockheed XC-35.

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Airy Chat

(*Continued from page 4*)

brought a snapshot of a diver, helmet and all, climbing up the side of a pier! So, dear readers, we haven't seen the guy's face either. Incidentally, a new author turned up the other day: Lieut. Frank R. Pancake, an Army flyer based in Puerto Rico. He gave us permission to kid about his name; we can't think of anything worth bothering the typesetters with at the moment. But you can't say our writers are a drab lot . . .

* * *

WHAT'S-IN-THE-WIND: Bell Aircraft Corporation employes recently received a memorandum warning them not to talk about what's going on inside the factory to persons outside. . . . The Army Air Corps recently awarded contracts for $7,815,731.64 worth of—gasoline! . . . After many ups and downs, TWA has definitely abandoned the slogan "The Lindbergh Line.". . . An aircraft factory in Brazil, producing from three to five airplanes a month, was organized by a naturalized Brazilian of German origin. . . . A gliding association in India just has ordered a fleet of gliders from England with which to train flyers. . . . From January to June, 1940, the U.S. exported 1,467 planes; from July to December of the same year, we exported 1,980 ships. . . . All Pan American transatlantic clippers have been stripped bare to accommodate tremendous loads between the U.S. and Lisbon; originally intended to carry only 1,600 pounds of mail per crossing, the war has boosted the clippers' mail loads as high as 13,400 pounds. . . .

The Douglas factory has made a special deal for shuttle freight trains to haul aircraft and sub-assemblies between eastern contractors and the Douglas plant at Long Beach, Cal.; special freight cars have been designed around the aircraft and will be operated by the Union Pacific, Southern Pacific and Santa Fe railroads. . . . The Buick automobile company just has set up a separate aircraft engine division and will produce plane engines under license; Buick's auto engine capacity is 2,000 complete units daily. . . . The Canadians now have 76 flying schools turning out military pilots . . . since this training began the R.C.A.F has had 29 fatal accidents (in 168,000 flying hours). . . .

* * *

FEW people know it, but there are more than 300 ex-CPTP students actively flying with the Royal Air Force in England . . . many of them went to the British after being turned down by the U. S. Army or Navy for any number of reasons, ranging from missing teeth to flat feet. . . .

James Church, Chicago engineer best known for his conversions of auto engines to aircraft use, has gotten an A.T.C. on a 93 h.p. air-cooled Ford engine that weighs ½ lb. per h.p. more than the average aircraft engine. . . .

The Glenn L. Martin company already is in production on $18,885,000 worth of B-26's. . . . One midwestern airline recently had a close call when one of its ships, flying on instruments, narrowly missed colliding with an Army plane flying the beam . . . the Army pilot had neglected to report his position by radio. . . . Certain rubber companies are testing synthetic tires for aircraft. . . . Curtiss-Wright is producing eight *Tomahawks* (P-40) daily for the British. . . . The CAA just has granted Franklin a certificate on a six-cylinder, air-cooled, 130 h.p. engine. . . . United Air Lines DC-3's are flying nothing but freight on certain schedules between Chicago and New York . . . the freight is piled in the aisle and on seats. . . . United pilots flying the company's new Lockheed *Lodestars*, incidentally, have had a few embarassing moments when discovering that the cabin door is opposite that on the DC-3's . . . the pilots have been parking the Lockheeds so that passengers have stepped out on the big, bare airport. . . .

* * *

OF Douglas's $347,000,000 backlog, less than 10 per cent is for commercial aircraft. . . . Menasco has a new 430 h.p. air-cooled engine coming up. . . . Consolidated soon may have to take on an additional factory in the middle west. . . . North American's production is reported to be running at 10 planes daily. . . . Consclidated is experimenting with plastic aircraft . . . incidentally, that company's engineers refer to their Model 31 flying boat as the "Pregnant Guppy" . . . the Model 31 carries 5,500 gallons of fuel and a commercial adaptation could carry 50 day passengers or 20 berths . . . the same company, meanwhile, has done some

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ONE Kilowatt radio phone transmitter. Will sell for $600 or will trade for light plane. This transmitter is perfectly constructed and in two six-foot relay racks. Parts alone cost several times price asked. Would make excellent transmitter for airport use. Robert H. Johnston, Wharton, Tex.

1941 CHEVROLET, new (37 miles) for small plane, 1 or 2 S. J. A. Wachs, 5634 Broadway, New York City.

1938 PLYMOUTH—extras. Trade for light plane. S. Helfetz, 1560 So. Boulevard, New York City.

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SONGWRITERS—Piano arrangements, Orchestrations written, special melody offer. Lewis Elliott, Martin, Tenn.

AIRLINE Hobby: Collect airline labels from all over the world. See Popular Science, December, 1939. Two different labels, list 20c. Start now. Geddes Aircraft, 18 Austin, New Britain, Conn.

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SELL 115 issues of Aero Digest 1931 through 1940. Write offer to Box 44, Cavetown, Md.

PATENTS

INVENTORS: Unpatented inventions now salable with positive safeguards under patent laws. New, low-cost procedure. Complete details, free. American Patents Corporation, Dept. 25, Washington, D. C.

work on a commercial version of its B-24 bomber. . . .

Brewster has contracts for 1,161 bombers and 421 fighters for the U.S. Navy, the Dutch East Indies and Britain. . . . There's hardly any night flying in Spain these days; reason is the lack of lighting facilities on either commercial or military fields. . . . The British say Douglas is turning out three *Bostons* (DB-7) a day and Lockheed is producing four *Hudsons* daily. . . . A recent air raid on Gibraltar was reported to have been made by American-built Martin 167F's originally sent to the French. . . . By using 100 octane fuel, the British have been able to get 1,300 h.p. out of the *Merlins* in the *Spitfires*. . . . It's reported that K. D. Parmentier, the famed Dutch pilot, has been granted permission by the R.A.F. to fly on solo night air raids on German bases in the Netherlands in a Dutch bomber . . . his entire family is reported to have been killed in the German air raids on Rotterdam. . . .

* * *

HOWARD HUGHES is said to be constructing television stations at Los Angeles and San Francisco. . . . The CAA recently told Pan American Airways it couldn't give a member of the Export Managers Club (New York) a free pass between San Francisco and Auckland, N.Z. . . . Curtiss-Wright's much-belabored CW-20 transport has been selected by the Army for a troop transport and cargo plane. . . . The Goodrich company is in production on a $2,000,000 order for bullet-sealing gasoline tanks. . . . Stearman is building one military trainer every three hours. . . . A new observation plane is the Douglas O-53. . . . We have just heard of a new single-seater being built in Los Angeles called the "Manta.". . . A Denver flyer recently was fined $50 for "flying over, disturbing and chasing geese" with his plane . . . a farmer got

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INVENTORS: Have you a sound, practical invention for sale, patented or unpatented? If so, write Chartered Institute of American Inventors, Dept. 119, Washington, D. C.

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SITUATIONS WANTED

WANTED: Apprenticeship to learn Aviation mechanics. Have taken Aviation Institute America course. Age 22. Ralph Collmann, Ireton, Iowa, R. D. 1.

WANTED: Job as apprentice mechanic. Good references. My only chance. Hack Haller, Sauk Centre, Minn., R. 1.

the plane's license number and reported it. . . . Aviation gasoline now is being produced in this country at a rate of 45,000,000 gallons per month; stocks have been increased to 200,000,000 gallons. . . . North American will build a huge factory in Kansas City where they will build B-25 bombers for the Army . . . this, added to their new plant at Dallas, Tex., is expected to bring the firm's total employment up to 40,000 (12,000 in their original factory in Inglewood, Cal., 13,000 in Dallas and 15,000 in Kansas City). . . .

National Aeronautics, official organ of the N.A.A., announced in its December issue that it would sponsor the premier of a new aviation movie, then published a faked photograph of a Navy fighter squadron in which Plane No. 6 in the Sixth Fighting Squadron is flying in three different positions in the same formation. . . . the squadron featured in the movie ("Flight Command"), incidentally, was the Eighth Fighting Squadron, not the Sixth. . . . Kent Sagendorph, columnist for a Chicago paper, recently wrote that, when Army Air Corps officials announced that two squadrons of Boeing B-17A's were to be flown from March Field, Cal., to their new base at Luke Field, Hawaii, the Navy, trying to limit the Air Corps to overland operations only, kicked about the proposed flight so vociferously that the huge bombers had to be dismantled and shipped to Hawaii on boats. . . .

There is agitation afoot by operators at Floyd Bennett Field, New York, to keep the Navy from taking over the entire airport. . . . The Army now has 3,500 planes on hand, the Navy, over 1,800. . . . There are nine flight instructors named Bill at the Ryan school in San Diego. . . . The Army has just ordered $4,097,412 worth of Link Trainers. . . .

* * *

Had enough? MAX KARANT

END

Aerial Camera

(*Continued from page 50*)

ship to work from are the new high wing, enclosed lightplanes. The rental fee for these ships is not excessive and their low speed is an asset to picture taking. Fly at such an altitude that the pilot can close the throttle and slip gently toward the subject as you shoot the camera. This will tend to eliminate the danger of vibration to a great extent.

Selling Your Prints

Good aerial photographs practically sell on sight. The best markets will be the owners and operators of local industrial buildings, homes of private citizens, owners of the better farms and shots of your fellow pilots in the air. Enlarge your best prints to 11x14. Always mount your prints neatly before presenting them to a prospective customer. Do not solicit work. Take the picture, finish it, then show it to whomever you think might be interested in that subject. The sales you make in this manner will easily defray the cost of those you do not sell.

One word of caution before closing. With a short focus lens of the type we used on the described camera, the field of view included is rather extensive. In order to get a larger image of the subject desired you may be tempted to coax your pilot to hedge-hop against his better judgment, at dangerously low altitudes to offset this disadvantage. We can only add here that no picture is worth risking your life for and you have no right to ask a pilot to place his ship in a dangerous position. Work at a safe altitude and offset this when you get your negative in your enlarger. When you make prints, make an extra one for your pilot now and then. They all appreciate them and will cooperate more readily the next time you fly.

END

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One of the first, and one of the most important books on the use of instruments in aviation was Howard Stark's "Instrument Flying." It presented for the first time important steps in instrument flying such as the 1-2-3 order of instrument control. For several years it was the instrument pilot's guide, and thousands of copies were sold and other thousands distributed gratis by Sperry Gyroscope Company.

In 1936 Howard Stark lost his life in the line of duty, with the result that his book gradually receded in the background as outdated. The authors of this book, seeing the inherent value in Stark's original work, purchased the copyright and have written a completely new book around the basic idea of Stark's excellent material.

The present book has been prepared with a view of meeting the requirements for the U. S. Government rating. In order to assist the student, numerous typical questions with answers are given at the end of the book. While this is a condensed repetition of the text in the body of the book, the student by use of the quiz section would be able to judge when he is sufficiently prepared for his written examination.

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Condensed Outline of Contents

The Airfoil: Operation of wind tunnel, balance. N.A.C.A.'s studies of related airfoils as guide to best airfoil-section shape for given application; to predicting flight characteristics. Relation of lift coefficient to speed. Measuring pressure along chord of airplane. Characteristics of drag, of the L/D ratio, of center of pressure travel. Effect of variation of airfoil dimensions Thick airfoils; comparison of characteristic curves. Lateral center of pressure. Aspect ratio. Effect of taper in planform, in thickness. Shape of airfoil tips. Applying Reynolds number in variable-density wind tunnel tests on model airfoils.

Selection of Airfoils: Data, methods of comparison. Five factors controlling selection. Reasons for varying values of gap/chord ratio and stagger. Pressure distribution tests over wings, tail surfaces. Downwash calculation.

Parasite Resistance: Struts. "Fineness ratio." Equations from Navy design data. Streamline wire. Fittings; rough approximations used in practice. Curves for calculating wheel resistance. Tests of various forms of fuselages as guides to design. Landing gear. Tail surfaces. Radiators. Air-cooled engines. Effects of various cowlings. Miscellaneous parts; general rules. Army estimating method. Short-cut method to use on new designs.

Propeller: Blade element theory. Thrust, torque. Design procedure. Tests. Characteristic curves. Aspect ratios. Rake. Diameter, pitch ratio effects. Structural details. Fixed-pitch, adjustable, controllable, automatic propellers. Selecting propeller for given airplane.

Complete Airplane: Four units. Axes. Fundamental motions. Angle of incidence. Ground, air speed; relative wind; angle of attack. Equilibrium in climb, glide, dive. Stabilizer setting. Ability of elevators to balance plane. Model tests. Positions of thrust line, of center of resistance. Balance requirements.

Stability: Determining dynamic stability. Static longitudinal stability. Position of c.g. with respect to wing chord. Tail plane. Resistance, thrust moments. Lateral, directional stability. Directional stability in flight.

Control Surfaces: Proportions of horizontal, vertical tail surfaces; of ailerons. Effects of airfoil thickness and planform on aileron controls. Aileron tests on complete models. Differential aileron control. Yawing moments. Balanced control surfaces. Auxiliary methods of lateral control. Formulas for control surface design. Brakes.

Performance: Calculation of horsepower-required curves for different altitudes. Computation of horsepower available. Landing speed. Best gliding angle. Endurance, range. Corrections for speed, scale effects. Other methods of performance prediction. Factors affecting performance.

Dynamic Loads: Question of strength. Accelerations in loops, spirals, tail spins, barrel rolls, miscellaneous maneuvers. Time histories of abrupt power-on, power-off pull-ups, barrel rolls, spins. Landing. Taking-off.

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Partial Outline of Contents

Flight Principles: Airfoil lift theories. Airfoil characteristics and coefficients. High-lift devices, slots and flaps. Center-of-pressure movement of airfoils. Airfoil flutter and vibration, balanced control surfaces. Aircraft drag and power required. Balance, stability, and control. Airplane performance. Minimum and maximum speed. Principles of autogiro flight. Direct controlled autogiro.

Airplane Construction and Operation: Essential components of airplanes. Historical development. Weight, loads, load factors. Center of gravity determination. Stresses on airplane parts. S.A.E. steels. Magnetic dust inspection of steel. Aluminum alloys. Bend allowance calculations. Riveting sheet metal. Fabric doping and finishing, repairing, inspecting. Dopes and lacquers. Cable splicing. Airplane structural details. Tube and spar splicing. Flying procedure. Operation with flaps and nose wheel. Elementary acrobatics.

Aircraft Propellers: Propeller theory. Operation with controllable propeller. Automatic propellers, hydraulic and electric. Construction of wood, steel, duralumin propellers. Propeller track and balance. Measuring propeller pitch.

Engine Principles: Theory of internal combustion engines. Otto cycle, Diesel cycle. Compression ratio and efficiency. Brake and indicated horsepower. Brake mean effective pressure. Octane rating. Thermal efficiency and specific fuel consumption.

Engine Construction and Operation: Types, radial and in-line. Controlling factors in operation. Terminology and construction of modern engines. Fuel, lubricating, cooling, ignition systems. Vibration and balance. Practical operating procedure. 20-hour check. Data for top overhaul.

Engine and Flight Instruments: Minimum equipment requirements for instrument night flying, for contact flying. Construction and operation of aircraft engine instruments, including tachometers, pressure gages, oil and liquid thermometers, fuel quantity gages. Construction and operation of aircraft flight instruments, including air-speed indicator, altimeter, rate-of-climb indicator, bank indicator, gyroscopic rate-of-turn indicator. Gyro Horizon, directional Gyro. Instrument flight training.

Safety Appliances and Communications: Parachutes: construction and care. Deicing equipment. Aeronautical communication. Collecting and distributing weather information. Two-way aircraft radio. Aircraft station equipment. Receiving and transmitting antennas. Radio interference. Radio range and marker beacons. Direction finders. Instrument landing system.

Avigation—Maps, Piloting, Radio, and Instruments: Value of avigation. Map making principles. Map projections used for avigation. Piloting technique and aids. Radio avigation. Construction and operation of avigation instruments. Magnetic compass and compass compensating systems. Swinging the compass. Compass deviation card. Time of flight indicator. Drift indicator. Ground-speed indicator.

Dead Reckoning: Basic principles. Headings, pointings, and courses. Rules for correcting for variation and deviation. Velocity vectors. Velocity triangles for graphical solution of dead reckoning problems. Double drift method. Determination of drift without drift indicator. Avigator's procedure sheet. Preparing a Flight Plan. Radius of action and interception problems.

Aeronautical Meteorology: Definitions. Elements of meteorology with measuring device and unit or expression employed. Adiabtic expansion and compression. Temperature. Dynamic cooling. Cooling by conduction and mixing. Identification of air masses. Pressure. Humidity. Condensation. Cloud types. Visibility and ceiling measurement. Precipitation. General and local wind systems. Veering and backing winds. Beaufort scale of wind speed. Sunshine. Lightning. Communication of weather information. Content and translation of Symbol Weather Reports. Weather and air masses. Warm and cold fronts. Airway Weather Maps. Development of cyclones. Weather forecasting.

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Mt. Sts. Avia., 3800 Dahlia St., Denver, Col.	Chief	Cont. 65	900 hr.	56 hr.	1500
Harmon J. Johnson, RD No. 4, Binghamton, N. Y.	Chief	Lyc. 65	300 hr.	200 hr.	1450
W. Arnet Speer, 3330 Barnet Ave., San Diego, Cal.	Tandem Tr.	Frnkln. 60	162 hr.	new	1450
G. E. Verhostra, 2010 Hollywd. Pl., So. Bend, Ind.	Chief '40	Lyc. dual 65	200 hr.	dem.	1400
Leeward Aircraft, New Kensington, Pa.	Trainer	Lyc. 65	15 hr.		1395
Buck Frame, Lovell Fd., Chattanooga, Tenn.	Tandems	Lyc. 65	100 hr.	new	1350
Hass-Hillyard Flyg. Serv., Municipal Arpt., Evansville, Ind.		Lyc. 65	500 hr.	100 hr.	1350
W. A. Crews, 1201 W. Ash, Blytheville, Ark.	Trainer (new)	Lyc. 65	15 hr.	15 hr.	1300
G. E. Verhostra, 2010 Hollywd Pl., So. Bend, Ind.	Tandem Tr.	Lyc.dual65	25 hr.	dem.	1300
Huron Flyg. Serv., Box 415, Huron, S. D.	C-65	Cont. 65	700 hr.	5/15/40	1300
Frantz Flyg. Serv., Box 2504, Roanoke, Va.	39	Cont. 65	1050 hr.	500 hr.	1300
C. W. Peterson, Mun. Arpt., Salina, Kansas.	Chief	Cont. 65	295 hr.	none	1295
Jos. R. Higgins, Mozart Pk., Wheeling, W.Va.	Low Wing	Warner 90	800 hr.	90 hr.	1275
G. E. Verhostra, 2010 Hollywd. Pl., So. Bend, Ind.	Tandem Tr.	Lyc.dual65	45 hr.	dem.	1275
Tred Avon Fly. Serv., Easton, Md.	Trainer	Lyc. 55	225 hr.		1275
Roscoe Turner Aeronautical Corp., Ind., Ind.	Chief	Cont. 65	300 hr.	top	1275
A. R. Smith, Mun. Arpt., Aberdeen, Miss.	Chief	Cont. 50	365 hr.	Nov. 5	1275
Tred Avon Fly. Serv., Easton, Md.	Chief	Lyc. 55	512 hr.		1250
Un. Aer. Corp., P.O. Box 222, San Antonio, Texas.	Chief 1939	Cont. 65	875 hr.	825 hr.	1250
Aeronca Sales, Munic. Arpt., Ft. Worth, Texas	Chief	Cont. 50	425 hr.	50 hr.	1250
Aeronca Sales, Munic. Arpt., Ft. Worth, Texas	Chief	Cont. 50	457 hr.	200 hr.	1250
Chic. Avia. Corp., Patwaukee Arpt., Mt. Prospect, Ill.	65-LA	Lyc. 65	700 hr.	none since	1245
Leeward Aircraft, New Kensington, Pa.	Chief	Cont. 50	135 hr.	5 hr.	1245
G. E. Verhostra, 2010 Hollywood Place, So. Bend, Ind.	Trainer	Lyc.dual65	75 hr.	dem.	1225
Edwards Fly. Serv., Flushing Arpt., Flushing, L.I.	Chief	Cont. 50	400 hr.	at375hr.	1200
Blvd. Arpt., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	Chief	Lyc. 55	240 hr.	no	1200
Whicker Fly. Serv. ,Mun. Arpt., Ft. Wayne, Ind.	T.	Frnkln. 60	150 hr.		1200
United Aero Corp., P. O. Box 222, San Antonio, Tex.	Chief	Cont. 65	780 hr.	700 hr.	1200
Aeronca Sales, Mun. Arpt., Ft. Worth, Texas.	Chief	Cont. 50	185 hr.		1200
Lenhart Fly. Serv., Munic. Arpt., Marion, Ind.	Trainer	Lyc. 65	65 hr.		1195
Baker-Eberle Aviation Co., Ct. Arpt., Detroit, Mich.	Chief	Frnkln. 50	250 hr.	never	1175
H. S. Smith, 422 S. Union St., Warsaw, Ind.	KC	Lyc. 50	567 hr.	topped	1175
Blvd. Arpt., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	Chief	Lyc. 50	500 hr.	150 hr.	1150
Blvd. Arpt., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	Chief	Lyc. 50	500 hr.	150 hr.	1150
Hass-Hillyard Fly. Serv., Mun. Arpt., Evansville, Ind.	LA-65	Lyc. 65	800 hr.	400 hr.	1150
Northern Air Service, Grand Rapids Arpt., Grand Rapids, Mich.	L.A.	Lyc. 50	900 hr.	yes	1150
United Aero Corp., P. O. Box 222, San Antonio, Texas.		Frnkln. 50	885 hr.	690 hr.	1125
Leeward Aircraft, New Kensington, Pa.	Trainer	Frnkln. 60	35 hr.		1095
Art Whitaker, Portland Arpt., Portland, Ore.	Trainer	Lyc. 65	700 hr.	500 hr.	1075
C. W. Peterson, Peterson Fly. Serv., Salem, Mass.		LeBlond 90	420 hr.	none	1075
United Aero Corp., P. O. Box 222, San Antonio, Texas.	Chief	Frnkln. 50	1350 hr.	1300 hr.	1050
Baker-Eberle Avia. Co., Cty. Arpt., Detroit, Mich.	Chief	Cont. 50	400 hr.	not yet	1025
J. A. Atherton, Rochester Arpt., Rochester, Minn.	Chief	Cont. 50	600 hr.	200 hr.	$1000
Louis A. Musgrove, Bx. 814, Morgantown, W. Va.	T.	Cont. 50	300 hr.	none	1000
J. A. Atherton, Rochester Arpt., Rochester, Minn.	Trainer	Lyc. 65	197 hr.	no	1000
New Mex. Fly. Serv., Box 67, Clovis, N. M.	Tandem	Lyc. 65	500 hr.	426 hr.	1000
United Aero Corp., P. O. Box 222, San Antonio, Texas	Trainer	Frnkln. 60	525 hr.	520 hr.	1000
United Aero Corp., P. O. Box 222, San Antonio, Texas.	Chief	Frnkln. 50	1100 hr.	1075 hr.	1000
Baker-Eberle Avia. Co., City Arpt., Detroit, Mich.	Chief "38"	Cont. 50	500 hr.	Just recent	1000
Baker-Eberle Avia. Co., City Arpt., Detroit, Mich.	Chief "38"	Cont. 50	1200 hr.	Just	1000
Lenhart Fly. Serv., Munic. Arpt., Marion, Ind.	Tr.	Frnkln. 60	340 hr.	300 hr.	995
Inter City Air Lines, Inc., Boston Mun. Arpt., E. Boston, Mass.	Chief	Menasco50	300 hr.		975
Jenkins Air Serv., Mun. Arpt., Rochester, N. Y.	Trainer	Frnkln. 60	700 hr.	700 hr.	975
C. W. Peterson, Mun. Arpt., Salina, Kansas.	LW	LeBlond 90	418 hr.	90 hr.	975
Sky Sport, Inc., Cincinnati Arpt., Sharonville, Ohio.	Chief	Frnkln. 50	700 hr.	550 hr.	975
Huron Fly. Service, Box 415, Huron, S. C.	KCA	Cont. 50	660 hr.	Oct. '40	950
United Aero Corp., P. O. Box 222, San Antonio, Texas.	Chief	Frnkln. 50	1450 hr.	1300 hr.	925
Aeronca Sales, Mun. Arpt., Ft. Worth, Tex.	KCA	Cont. 50	200 hr.		900
Edwards Fly. Serv., Fishing Arpt., Flushing, L.I. N. Y.	Trainer	Frnkln. 60	260 hr.	10/24/40	875
Ellis Eugene Eno, Eno Arpt., Fort Dodge, Iowa.	Chief	Cont. 50	425 hr.	recently	875
Ellis Eugene Eno, Eno Arpt., Fort Dodge, Iowa.	Chief	Cont. 50	450 hr.	never	850
Geo. T. Webb, Oneida, Tenn.	K		300 hr.	recent	750
J. S. Barham, Airport, Santa Rosa, Calif.	K	Aeronca	380 hr.	no	700
Tred Avon Fly. Service, Easton, Md.	SeaplaneC-3	Aeronca36			700
Oakland Aircraft Corp., Alameda, Cal.	K	Aero. 40	730 hr.	Oct. '39	650
Tred Avon. Fly. Service, Easton, Md.	K	Aeronca40	503 hr.	50 hr.	600
Aero-Way's, Inc., Mun. Arpt., Cleveland, O.	K	45 h.p.	328 hr.	298 hr.	600
Morgantown, W. Va.	K	Aeronca45	420 hr.	60 hr.	600
Hawthorne Fly. Serv., Mun. Arpt., Charleston, S. C.	K	Aeronca40	583 hr.		595
Tred Avon Fly. Service, Easton, Md.	KC	Cont. 40	700 hr.		550
E.H. Brockenbrough, Mun. Arpt., Charlotte, N.C.	KC	Cont.	488 hr.	88 hr.	550
Leeward Aircraft Sales, New Kensington, Pa.	K	Aeronca40	340 hr.	50 hr.	595
John K. Hinson, Rutherford Arpt., Baltimore, Md.	KC	Cont. A 40	350 hr.	14 hr.	595
Philip A. Meinke, Route 3, Willoughby, Ohio.	C-3	Aero. 36		5 hr.ago	575
Oscar L. Hostetter, York Arpt., Thomasville, Pa.	K	Aeronca40	750 hr.	100 hr.	525
Howard G. Nayes, Box 2104, Huntington, W. Va.		Aeronca40	515 hr.	recently	485
Red Bank Airport, Inc., Red Bank, N. J.	C3	Aeronca40	900 hr.	55 hr.	395
ARROW SPORT					
E. R. Elliott, Elliott Motors, Coeur d'Alene, Idaho		Ford V-8	195 hr.		850
Hobley-Maynard Air Serv., New Orleans Arpt., New Orleans, La.	Ford 85		400 hr.	20 hr.	750
Aero-Ways, Inc., Mun. Arpt., Cleveland, Ohio.		Ford	450 hr.		525
BEECH					
Harry A. Hammill, Box 992, Austin, Texas.	D-17-S	Wasp 450	532 hr.		8500
Harry A. Hammill, Box 992, Austin, Texas.	D-17-R	Wright450	900 hr.	700 hr.	8000
Hass-Hillyard Fly. Serv., Mun. Arpt., Evansville, Ind.	B-17 E	Wright 285	1100 hr.	75 hr.	4000
BEECHCRAFT					
Harry A. Hammill, Box 992, Austin, Texas.	F-17-D	Jacobs 330	900 hr.	70 hr.	8500
California Aircraft Corp., P. O. Box 170, Van Nuys, Calif.	E17B	Jacobs 285	500 hr.	just	6600
Colorado Aviation Co., 426 U. S. Nat'l B.B., Denver, Colorado.	C17B	Jacobs 285	700 hr.	yes	5250
BELLANCA					
Art Whitaker, Portland Arpt., Portland, Ore.		KenRoyce90	90 hr.	none	3500
BIRD					
Edwards Fly.Serv., Flushing Arpt., Flushing, L.I.	4 place	Kinner 125	60 hr.	complete	1500

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
BUHL					
Pekrul's Fly. Serv. Traverse City Arpt., Mich.	C-A6	Wright 330	1070 hr.	60 hr.	$2500
Aero Brokerage Service, Inc., Metro. Arpt., Van Nuys, Calif.	Pup	Szekely 45	624 hr.	48 hr.	575
CESSNA					
Wallace Aircraft Co., Clarcona, Florida		Warner 165	50 hr.	new	7995
Hangar Six, Inc., Stinson Fld., San Antonio, Texas	Airmaster	Warner 165	100 hr.		7000
Northern Okla. Fly. Serv., P.O. Box 556, Blackwell, Okla.	C-36	Warner 145	1310 hr.	63 hr.	2400
Aero Service, Inc., McKinley Arpt., Canton, Ohio	4PCLM	Wright J-6-7	425 hr.	130 hr.	1150
Bob Wight, Box 487, Biloxi, Miss.	AW	Warner 125	550 hr.	220 hr.	950
L-H Air Serv. County Line, Hatboro, Pa.	A-W	Warner 125	750 hr.	30 hr.	650
COMMANDAIRE					
Wm. T. Anderson, P. O. Box 275, Essex Falls, N. J.		Chall. 185	635 hr.	yes	600
Charles Ferris, Hillside, Ill.		Warner 125	410 hr.	170 hr.	525
CULVER CADET					
Port Columbus Fly. School, P. Col., Col., Ohio.		Cont. 75	100 hr.	no	2000
Lane Avia. Corp., Cleveland Arpt., Cleveland, Ohio		Cont.	150 hr.	no	2000
Sky Sport Inc., Cincinnati Arpt., Sharonville, Ohio		Cont. 75	100 hr.		2000
New Mexico Fly. Serv., Box 67, Clovis, N. M.		Cont. 75	77 hr.		1900
CURTISS ROBIN					
Leeward Aircraft, New Kensington, Pa.		Chall. 185	512 hr.	17 hr.	885
Geo. Roper, 27 S. State, Salt Lake City, U.		Challenger	800 hr.	Mar. '40	800
Ralph L. Burton, Alliance Fly. Serv., Mun. Arpt., Alliance, Ohio		Chall. 180	350 hr.	140 hr.	750
Al Leeward, New Kensington, Pa.		Challenger 185	500 hr.	110 hr.	745
A. A. Goldsmith, Nashua, N. H.		Wright J65	700 hr.	150 hr.	700
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	C-1	Chall. 185			600
Fred Kelm, Zap, No. Dakota		Chall. 185	750 hr.	1939	500
DART					
California Aircraft Corp., P. O. Box 170, Van Nuys, Calif.	GK	Ken Royce 90	300 hr.		2750
Ashcraft Bros. Fly.Serv., Mun. Arpt., Lawrence, Kansas		Ken Royce	375 hr.	Top-325 hr.	2000
DAVIS					
New Mexico Fly. Serv., Box 67, Clovis, N. M.	D-1	LeBlond 60	700 hr.		650
DRIGGS					
Northern Air Serv., Grand Rapids Arpt., Grand Rapids, Mich.	Skylark	Cirrus Hi-Drive 95	425 hr.	yes	900
DUSTER					
J. L. Schroeder, Inc., Rt. 3, Box 117, Houston, Texas	Commander	Chall. 185	700 hr.	15 hr.	850
L. L. Schroeder, Inc., Rt. 3, Box 117, Houston, Texas	Consolidated O-17	Wright J-5 220 h.p.	800 hr.		675
FAIRCHILD					
Cutter Carr Fly. Serv., P. O. Box 274, Albuquerque, N. Mex.	24	Ranger 175	200 hr.		6350
Colorado Aviation Co., 426 U. S. Nat'l B. B. Denver, Colo.	24	Ranger 165	400 hr.	yes	6000
Carolina Aircraft Sales, Mun. Arpt., Charlotte, N. C.	24	Warner 145	130 hr.	new	5500
Wallace Aircraft Co., Clarcona, Fla.	24	Warner 145	350 hr.		4500
T. A. Colbertson, Medford, Oregon	246	Warner 145	800 hr.	350 hr.	3500
Aircrft. Unlimited, Inc., Hangar 7, Roosevelt Field, Mineola, L. I., N. Y.	24 1937	Ranger 165	500 hr.	350 hr.	2995
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois	R24	Ranger 145	690 hr.	275 hr.	2900
Cutter Carr Fly. Serv., P. O. Box 274, Albuquerque, N. M.	24	Warner 145	700 hr.	220 hr.	2750
W. Va. Air Serv., Inc., City Arpt., Clarksburg, W. Va.	24	Warner	601 hr.	90 hr.	2750
Inter City Airlines, Boston Mun. Arpt., East Boston, Mass.	24	Warner 145	1200 hr.	150 hr.	2475
John P. Hall, W. Haven Arpt., W. Haven, Conn.	24	Warner 145	340 hr.	recently	1695
Chicago Avia. Corp., Curtiss Arpt., Glenview, Ill.	24	Warner 125	520 hr.	100 hr.	1595
Doug Schall, 33 Claggett Rd., Hyattsville, Md.	KR 34	Wright 185			1275
Harrisburg Air Serv., Harrisburg, Pa.		Wright	800 hr.	200 hr.	1100
Piedmont Avia., Box 1941, Winston-Salem, N. C.	KR 34	Wright 165	657 hr.	300 hr.	925
Harrisburg Air Serv., Penn-Harris Arpt., Harrisburg, Pa.	KR-34	Wright J65-175	1193 hr.	1143 hr.	900
Wm. T. Anderson, P. O. Box 275, Essex Falls, N. J.	24-G8	Cirrus 95	580 hr.	yes	850
Doug Schall, 33 Claggett Rd., Hyattsville, Md.	KR 31	Kinner 100			800
Wm. T. Anderson, P. O. Box 275, Essex Falls, N. J.	24-C-8	Cirrus 95	560 hr.	yes	800

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
FLEET					
Lynchburg Air Trans. & Sales Corp.		125 h. p.	1000 hr.	July	$2300
Preston Glenn Arpt., Lynchburg, Va.	9	Kinner B-5			
Inter City Airlines, Boston Mun. Arpt., E. Boston, Mass.	Model Tr.	Kinner 125		Major	1750
Lynch. Air Trans. & Sales Corp.,		Kinner B-5	1000 hr.	July	1700
Preston Glenn Arpt., Lynchburg, Va.		125 h. p.			
H. A. Hammill, Box 982, Austin, Texas.		Warner 125	700 hr.	35 hr.	1500
McInnis Aviation Serv., Minn. Mun. Arpt., Minneapolis, Minn.		Warner 125	1685 hr.	270 hr	1050
FRANKLIN SPORT					
Weymouth Haver, Lebanon, N. J.		Lambert 90	600 hr.	May '40	600
FUNK					
Bailey Fly. Ser., Box 346, Corning, N. Y.	Model E	Funk 75	175 hr.	no	1400
GREAT LAKES					
Hudson Valley Aircraft Inc., 60 Dolson Ave., Middletown, N. Y.	American Cirrus Mark III	90 h. p.	320 hr.	Nov. '40	850
Sky Harbor Inc. R. R. No. 11, Box 551, Indianapolis, Ind.	2T1A	Cirrus 100	650 hr.	Aug. '40	800
P. A. Meinke, Route 3, Willo, Ohio	2T1A	Cirrus 90	950 hr.	100 hr.	650
KINNER					
Fredericksburg Air Serv., Nottingham, Fld., Fredericksburg, Va.	Sportwing	Kinner B5	915 hr.	265 hr.	1350
		125 h. p.			
Pac. Dis. Corp., 1321 Flower St., Glen., Calif.	Bird K5	Kinner 100	937 hr.	350 hr.	1000
Pac. Dis. Corp., 1321 Flower St., Glen., Calif.	Sport K5	Kinner 100	1375 hr.	675 hr.	1000
Louisville Fly. Serv., Bowman Fld., Louisville, Ky.	Sportster	Kinner 100	466 hr.	c'p't'ly	995
California Aircraft Corp., P. O. Box 170, Van Nuys, Calif.	K5	Kinner 100	1000 hr.	just	985
KITTY HAWK					
Safair, Inc., Roosevelt Field, Mineola, N. Y.		Siemens Halske	675 hr.		550
LAIRD					
Johannesson Fly. Serv., Stevens. Arpt., Winn., Can.	LC200	Wright J5-220	1250 hr.	50 hr.	950
LOCKHEED VEGA					
H. A. Hammill, Box 992, Austin, Texas		Wasp	15 hr.		5000
LUSCOMBE					
California Aircraft Corp., Box 170, Van Nuys, Calif.		Warner 90	300 hr.		2985
Falcon Aircraft Corp., L. A. Mun. Arpt., Inglewood, Calif.	Silvaire	Cont. 75	20 hr.		2650
Carl Evers, 247 Park Ave., N. Y, N. Y.	Silvaire 75	Cont. 75	Exhibit	ship	2650
C. W. Peterson, Municipal Arpt., Salina, Kans.	8A	Cont. 65	60 hr.	none	2295
Arents Air. Serv., Armonk Village, N. Y.	Silvaire	Cont. 75	500 hr.		2250
Falcon Aircraft Corp., L. A. Mun. Arpt., Inglewood, Calif.	8A	Cont. 65			2200
Falcon Aircraft Corp., L. A. Mun. Arpt., Inglewood, Calif.	8A	Cont. 65	140 hr.	top40hr.	2000
R. C. Davis, 328 N. Adams St., Glendale, Cal.	8A	Cont. 65	135 hr.	none	2000
Red Bank Arpt., Red Bank, N. J.	8A	Cont. 65	45 hr.	sincenew	1900
Arents Air Serv., Armonk Village, N. Y.	8A	Cont. 65	575 hr.	575 hr.	1850
Arents Air Serv., Armonk Village, N. Y.	8A	Cont. 65	625 hr.	600 hr.	1800
Midwest Av. Sales, Stinson Arpt., LaGrange, Ill.		Lyc. 65	125 hr.		1800
Falcon Aircraft Corp., L. A. Mun. Arpt., Inglewood, Calif.	8A	Cont. 65	100 hr.	Major 58 hr.	1750
Jersey Fly. Serv., Oakland, N. J.	8A	Cont. 65	90 hr.	none	1700
Sioux Skyways, Inc., Mun. Arpt., Sioux Falls, S. D.	8B	Lyc. 65	250 hr.		1675
J. L. Wells, 106 W. Main, Avon Park, Fla.	8A	Cont. 65	95 hr.	none	1675
Johannesson Fly. Serv., Stevenson Arpt., Winnipeg, Can.		Cont. 50	500 hr.	June '40	1650
A. E. Padags, 340 Park St., Wis. Rap., Wis.	8A	Cont. 65	455 hr.	55 hr.	1650
Sioux Skyways, Inc., Mun. Arpt., Sioux Falls, S.D.	8A	Cont. 65	735 hr.		1550
A. E. Padags, 340 Park St., Wis. Rap., Wis.	8B	Lyc. 65	275 hr.	none	1550
A. E. Padags, 340 Park St., Wis. Rap., Wis.	8	Cont. 55	450 hr.	none	1350
Northern Air Serv., Grand Rapids Arpt., Gr. Rapids, Mich.	8A	Cont. 65	950 hr.	yes	1300
MONOCOACH					
Carnahan Flyg. Serv., Arpt., Bloomington, Ill.		Wright	998 hr.	165 hr.	995
MONOCOUPE					
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	145	Warner 145	20 hr.	No	5900
St. Louis Fly. Serv., Lambert Fld., Robertson, Mo.	DeLuxe	Lambert 90		Recently	1950
Robert Belt, Red Oak, Iowa	90-A	Lambert 90	468 hr.	325 hr.	1650
Bennett Air Serv., P.O. Box 247, Hightstown, N.J.	6-W	Warner-Scarab 125	1290 hr.	74 hr.	1200
Chi. Avi. Corp., Curtiss Arpt., Glen., Ill.	90	Lambert 90	490 hr.	70 hr.	1195
Aero Serv., Inc., McKin. Arpt., Canton, Ohio.		War-Scar 125	750 hr.	80 hr.	1150
Oakland Aircraft, Alameda, Cal.		Lambert 90	688 hr.	Feb. '39	850
MOTH					
Carl Evers, 247 Park Avenue, N. Y., N. Y.	Gipsy Major 130		New		2800

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
NICHOLAS-BEAZLEY					
Ralph L. Burton, Alliance Fly. Serv., Mun. Arpt., Alliance, Nebraska	Model 8	Genet 80	585 hr.	none	$500
PIPER CUB					
George C. Haven, Schenectady County Arpt., Schenectady, N. Y.	Cub Cpe.	Cont. 65	20 hr.	no	2000
Stiles Motor Co., 260 Main St., Northport,N.Y.	Coupe J4A	Cont. 65	84 hr.	New	1990
J. A. Field, 17 Forman St., Bradford, Pa.	J-3-C	Cont. 65	40 hr.	no	1900
J. A. Field, 17 Forman St., Bradford, Pa.	J4	Cont. 65	15 hr.	no	1900
Hudson Valley Aircraft Co., 68 Dolson Ave., Middletown, N. Y.	Coupe J4	Cont. 65	40 hr.	Oct. '40	1800
L-H Air Serv., Hatboro Arpt., Hatboro, Pa.	J4	Cont. 65	130 hr.	none	1800
Hangar Six, Inc., Stinson Fld., San An., Texas	J-4	Cont. 65	310 hr.		1775
John K. Hinson,Rutherford Arpt.,Baltimore,Md.	Coupe '40	Lyc. 65dual	78 hr.	78 hr.	1768
Lynchburg Air Trans. & Sales Corp., Preston Glenn Airport, Lynchburg, Va	Coupe '40	Cont. 65	200 hr.	25 hr.	1750
N. Mex. Fly. Serv., Box 67, Clovis, N. Mex.	Cruiser	Cont. 75	64 hr.	No	1725
Gerald W. Richardson, Pt. Erie Arpt., Erie, Pa.	Cruiser J5	Cont. 75	38 hr.	New	1695
Skellys Fly. Serv., Greenville Arpt., Greenville, Pa	J4 Coupe	Cont. 65	90 hr.	new	1695
Piedmont Avia., Box 1941, Winston-Salem, N. C.	Coupe '40	Cont. 65 dual	122 hr.		1685
Elliott Fly Serv. Clinton City Arpt., DeWitt, Ia.	J5	Cont. 75	125 hr.		1675
John Ruzicka, Circus City Arpt., Peru, Ind.	Cruiser J5	Cont. 75	18 hr.	none	1650
M. F. Warrington, Cub Air Serv., Selbyville, Del.	Cruiser	Cont'1A-75	Brand new		1650
Robert Belt, Red Oak, Iowa	J5A	Cont. 75	75 hr.		1650
Elliott Fly. Serv., Clinton City Arpt., DeWitt,Ia.	Cruiser	Cont. 75	140 hr.	none	1650
Bethany Air Serv., Inc., Bethany, Conn.		Cont.	78 hr.		1650
Sprgfld Avia. Co., Mun. Arpt., Sprgfld, Ill.	Coupe '39	Cont. 65	247 hr.		1600
J. A. Field, 17 Forman St., Bradford, Pa.	J-3-C-65	Cont.65 d'l	40 hr.	no	1600
Racine Fly. Serv., Racine Arpt., Racine, Wisc.	Cub '40	Cont. 65	250 hr.	210 hr.	1600
Aero Brokerage Serv., Metro. Arpt., Van Nuys, Calif.	Coupe	Cont. 65	210 hr.		1600
Des Moines Fly. Serv., Mun. Arpt., Des Moines, Iowa	Cruiser	Cont. 75	30 hr.	new	1575
McBoyle Cub Sales, Lake Delton Arpt., Lake Delton, Wis	Cub	Cont. 75	75 hr.	new	1575
Matt. & Rappa, Roosevelt Fld., Min., N. Y.	Coupe	Cont. 65	285 hr.	7-5-40	1575
Jersey Fly. Service, Oakland, N. J.	Cruiser J-5	Cont. 75	135 hr.	none	1550
J. A. Field, 17 Forman St., Bradford, Pa.	J-4 1939	Cont. 65	80 hr.	no	1550
LD Fly. Serv., Euclid Ave. Arpt., Willo., Ohio.	Coupe	Cont. 65	160 hr.	no	1550
Rocky Mount Fly. Serv., Mun. Airp. R. Mt., N.C.	Coupe J-4	Cont. A 65	130 hr.	none	1550
R. E. Lee, Munic. Arpt., Rocky Mount, N. C.	Coupe J-4	Cont. A 65	120 hr.	no	1550
Southern Air Serv., Memphis, Tenn.		Cont. 65	100 hr.	new	1550
Air City Fly.Serv.,5500 E. Third St.,Dayton,O.	Cruiser	Cont. 75	150 hr.		1545
Bob Wight, Box 487, Biloxi, Miss.	Cruiser	Cont. 75	237 hr.	New motor	1525
Art Whitaker, Portland Arpt., Portland, Ore.	Coupe '39	Cont. 65	365 hr.	365 hr.	1500
Des Moines Fly.Serv.,Mun.Arpt.,Des Moines,Ia.	Coupe	Cont. 65	300 hr.	none	1500
Safair, Inc., Roosevelt Field, Mineola, N.Y.	Coupe	Cont. 65	290 hr.		1500
McBoyle Cub Sales, Lake Delton Arpt., Lake Delton, Wis	Cub	Cont. 75	150 hr.	new	1500
Bethany Air Serv., Bethany, Conn.		Cont.	201 hr.		1500
Seidner Fly. Serv., S.A.M. Arpt., Youngstown, Ohio	J4	Cont. 65	212 hr.	new	1495
Bennett Air Serv.,P.O.Box 247,Hightstown,N.J.	Cruiser J5	Cont. 75	206 hr.	20 hr. since	1475
Seidner Fly. Serv., S.A.M. Arpt., Youngstown, Ohio	Cruiser	Cont. 75	110 hr.	'40 mdl.	1475
Lexington Fly. Serv., Mun. Arpt., Lexington, Ky.	Cruiser	Cont. 75	184 hr.		1475
B. F. Hines, P.O. Box 535, Hobbs, N. M.	J-3	Frnkln. 65	51 hr.	no	1468
B. F. Hines, P.O. Box 535, Hobbs, N. M.	J-3	Lyc. 65	112 hr.	no	1468
Earl J. Friedell, Hawthorne Fly. Serv., Charleston, S. C.	J-5	Cont. 75	100 hr.		1450
Hylan Flyg. Serv., Rochester, N. Y.		Cont. 65	450 hr.	25 hr.	1450
Aircraft Unlimited, Roosevelt Fld., Mineola, L. I.	Coupe	Cont. 65	220 hr.	Tpd. 200 hr.	1425
Thomas Met. Toledo Mun. Arpt., Toledo, O.	Cruiser J-5	Cont. 75	180 hr.	never	1425
Bob Wight, Box 487, Biloxi, Miss.	Coupe 39	Cont. 65	175 hr.		1400
McInnis Avia. Serv., Minnea. Munic. Arpt., Minneapolis, Minn.	J3	Lyc. 65	18 hr.	new	1350
McInnis Avia. Serv., Minnea. Munic. Arpt., Minneapolis, Minn.	J3	Lyc. 65	18 hr.	new	1350
Orangeburg Fly.Serv.,Box 250,Orangeb.,S.C.	J-3	Lyc. 65	15 hr.	none	1350
Robert Belt, Red Oak, Iowa	J 5A cruiser	Cont. 75	450 hr.		1350
John K. Hinson, Rutherford Arpt., Balt., Md.	'39 Coupe	Cont. 65 dual	283 hr.	5 hr.	1350
J.L. Schroeder, Rt. 3, Box 117, Houston, Tex.	J3-F Trainer	Frnkln. 65	70 hr.	none	1338
Bennett Air Serv., P. O. Box 247, Hightstown, N. J.	J-4	Cont. 65	163 hr.	just	1325
McInnis Avia. Serv., Minnea. Munic. Arpt. Minneapolis, Minn.	J3	Lyc. 65	40 hr.	new	1325
McInnis Avia. Serv., Minnea. Munic. Arpt., Minneapolis, Minn.	J3	Lyc. 65	52 hr.	new	1325
Neil McCray Airport, Jamestown, N. Y.	Coupe '39	Cont. 65	160 hr.		1325
J. L. Schroeder, Rt. 3, Box 117, Houston, Tex.	J-3	Cont. 65	25 hr.	new	1300
Avia. Serv. Co., Inc., Brainard Fld., Hartford, Conn.	J3C-65	Cont. 65	15 hr.	new	1300
McInnis Avia. Serv., Minnea. Mun. Arpt., Minneapolis, Minn.	J3	Lyc. 65	136 hr.	new	1300
McInnis Avia. Serv., Minnea. Mun. Arpt., Minneapolis, Minn.	J3	Lyc. 65	121 hr.	new	$1300
McInnis Avia. Serv., Minnea. Mun. Arpt., Minneapolis, Minn.	J3	Lyc. 65	116 hr.	new	1300
L-D Fly. Serv., Euclid Ave. Arpt., Will., Ohio.	J3-60	Frnkln. 60	125 hr.	no	1300
W. Arnet Speer, 3330 Barnett, S.Diego, Calif.		Cont. 50	1740 hr.	366 hr.	1300
Piedmont Avia., Box 1941, Winston-Salem, N. C.	Coupe '39	Cont. 65	435 hr.	59 hr.	1295
McBoyle Cub Sales, Lake Delton Arpt., Lake Delton, Wisc.	J3 Spcl.	Lyc. 65D	60 hr.	new	1275
Rudy Pekrul, Traverse City Arpt., Michigan.	J-3-L	Lyc. 65	150 hr.		1250
Decatur Avia. Co., 776 S. Mafflt St., Decatur, Ill.	J3C	Cont. A-65	220 hr.		1250
Baker-Eberle Avia. Co., City Arpt., Detroit, Mich.	Coupe	Cont. 65	330 hr.	just	1250
W.Va. Air Serv., Box 401, Cnty. Arpt., Clarksburg, W. Va.	Trainer	Lyc. 65	170 hr.		1250
W. Arnet Speer, 3330 Barnett, S. Diego, Cal.	J3F	Frnkln. 50	900 hr.	25 hr.	1250
W. Arnet Speer, 3330 Barnett, S. Diego, Cal.	J3F	Frnkln. 50	832 hr.		1250
Inter-City Fly. Serv., Mun. Arpt., Ft. Wayne, Ind.	Sport	Frnkln. 65	103 hr.		1225
McInnis Avia. Serv., Minnea. Mun. Arpt., Minneapolis, Minn.	J3	Lyc. 65	210 hr.	new	1200
M. F. Warrington, Cub Air Serv., Selbyville, Del.	J-3	Cont. A-55	40 hr.	no	1200
Barr Aviation Corp., Detroit, Mich.		Cont. 65	230 hr.	none	1200
Jerry C. Gendron, 208 W. Aurora St., Ironwood, Mich.	1940	Lyc. 65	75 hr.		1195
M. F. Warrington, Cub Air Serv., Selbyville, Del.	Sport Trainer	Cont.A-55	40 hr.	no	1175
Art Whitaker, Portland Arpt., Portland, Ore.	Sport	Frnkln. 50	1200 hr.	1200 hr.	1150
Maheux's Arpt., Stevens Mill Rd., Auburn, Maine	Seaplane J-2	Cont. 40	346 hr.	just	1150
Bowman Fly. Serv., Arpt., Keene, N. H.	J3L	Lyc. 50	460 hr.		1150
Bethany Air Serv., Bethany Arpt., Beth., Conn.	J4	Cont. 50	242 hr.		1150
Va. Cub Dist., Inc., Box 211, Farmv., Va.	Trainer	Lyc. 65	250 hr.		1150
M. F. Warrington, Cub Air Serv., Selbyville, Del.	Trainer J-3	Cont. A-55	35 hr.	checked	1100
Frank Rensma, Youngsville, Box 441, Youngsville, Pa.	J3	Lyc. 65	81 hr.		1100
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.	J3	Cont. 65	1402 hr.		1100
M. F. Warrington, Cub Air Serv., Selbyville, Del.	Sport	Cont. 55	35 hr.	no	1100
Seidner Fly. Serv., S.A.M. Arpt., Youngstown, Ohio.	J-4	Cont. 65	230 hr.	1939 model	1100
Sweet Fly. Serv., Visalia Mun. Arpt., Visalia, Calif.	J-3-F-50	Frnkln. 50	829 hr.	now	1100
Wm.T.Anderson,P.O.Box 275,Essex Fells,N.J.	J-3L	Lyc. 55	190 hr.	topped	1100
G. L. Williams, Syracuse Arpt., Syracuse, N. Y.	J3f-60	Frnkln. 60	620 hr.	just	1100
Wm.T. Anderson, P.O. Box 275, Essex Fells, N.J.	J-3-L	Lyc. 55	190 hr.	top	1100
Neil McCray Arpt., Jamestown, N. Y.	J-3	Lyc. 65	300 hr.		1100
G. L. Williams, Syracuse Arpt., Syracuse, N.Y.	J3F-60	Frnkln. 60	825 hr.	735 hr.	1100
Robert C. Howe, Gardner Arpt., Gardner, Mass.	J-3	Frnkln. 60	165 hr.		1095
B. F. Hines, P.O. Box 535, Hobbs, N. M.	J-3	Frnkln. 55	500 hr.	75 hr.	1090
Somerset Hill Arpt., Basking Ridge, N. J.	J3L	Lyc. 65	225 hr.	no	1090
Oscar L. Hostetter, York Arpt., Thomasville, Pa.	Coupe	Cont. 65	350 hr.	none	1075
Hylan Fly. Serv., Rochester Arpt., Rochester, N. Y.	J-3	Cont. 65	775 hr.	9 3 40	1050
Ralph L. Burton, Alliance Fly. Serv., Munic. Arpt., Alliance, Nebraska	J3-F50	Frnkln. 50	200 hr.	200 hr.	1050
Wenatchee Air Serv., Rt. 4, Wena., Wash.	J3	Cont. 50	575 hr.	30 hr.	1050
Air City Fly. Serv., 5500 E. Third St., Dayton, Ohio	J-3	Frnkln. 50	650 hr.	yes	1045
Ben C. Arquitt, Mun. Arpt., Lima, Ohio	J-3	Frnkln. 60	187 hr.		1025
Fayette Airways, Connellsville Arpt., Uniontown, Pa.	J3	Cont. 65	175 hr.		1000
Rannells Air Serv., Arpt., Cumberland, Md.	J3	Frnkln. 60	500 hr.	no	1000
L. Dethloff, Airport, Willoughby, Ohio	J-3	Frnkln.	572 hr.	o e	1000
Al Gillis Fly. Serv., Great Falls, Mont.		Frnkln. 50	200 hr.	none	995
Somerset Hills Arpt., Basking Ridge, N. J.	J3F	Frnkln. 60	650 hr.	no	990
Ben C. Arquitt, Mun. Arpt., Lima, Ohio.	J3	Frnkln. 60	296 hr.	252 hr.	985
Jersey Fly. Serv., Oakland, N. J.	J3	Dual Frnkln. 60	330 hr.	40 hr.	975
J. A. Field, 17 Forman St., Bradford, Pa.	J-3-F-50	Frnkln. 50	465 hr.	yes	975
Barr Avia. Corp., Detroit City Arpt., Detroit, Mich.	Tr J3	Frnkln. 50	490 hr.		975
Lane Avia. Corp., Cleveland Arpt., Cleve., O.	Coupe	Cont. 50	150 hr.	no	975
Ben C. Arquitt, Mun. Arpt., Lima, Ohio.	J3	Frnkln. 60	314 hr.	272 hr.	970
W. C. Gage, Compton Arpt., Compton, Calif.	J3	Frnkln. 50	1556 hr.	1545 hr.	950
Al Gillis Fly. Serv., Great Falls, Mont.		Cont. 50	734 hr.	10 hr.	950
McInnis Avia. Serv., Minnea. Mun. Arpt., Minneapolis, Minn.	J3	Cont. 50	1100 hr.	50 hr.	950
Ray Wilson, Park Hill Arpt., Denver, Colo.	J3F	Frnkln. 50	1175 hr.	80 hr.	950
Ray Wilson, Park Hill Arpt., Denver, Colo.	J3F	Frnkln. 50	1290 hr.	115 hr.	950
Des Moines Fly. Serv., Munic. Arpt., Des Moines, Ia.	J3	Frnkln. 60	380 hr.	none	950
Fayette Airways, Connellsville Arpt., Uniontown, Pa.	J3	Frnkln. 65 4	25 hr.	11/10/40	950
Safair Inc., Roosevelt Fld., Mineola, N. Y.	Trainer	Frnkln. 50	750 hr.	20 hr.	950
W. Va. Air Serv., Box 401, County Arpt., Clarksburg, W. Va.	Trainer	Frnkln. 50	170 hr.		950
Utah Pacific Airways, Inc., Box 1187, Ogden, U.	J3	Lyc. dual 55	1193 hr.	1165 hr.	950
Ben. A. Funk, Grover, Mo., Hy. 50		Frnkln. 50	550 hr.	250 hr.	950
Clinton Arpt., Elliott Fly. Serv., DeWitt, Ia.	J3	Frnkln. 50	550 hr.		950
Harrisburg Air. Serv., Penn.-Harris. Arpt., Harrisburg, Pa.	J3L	Lyc. 55	910 hr.	825 hr.	950

FLYING and POPULAR AVIATION USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Va. Cub Dist., Inc., Box 211, Farmville, Va.	Trainer	Lyc. 50	400 hr.		$950
Rocky Mt. Fly. Serv., Mun. Arpt., Rocky Mt., N. C.	J3	Frnkln. 55	400 hr.	none	950
L-D Fly. Serv., Euclid Ave. Arpt., Willo., Ohio	J3-50	Frnkln. 50	650 hr.	no	950
W. A. Crews, 1201 W. Ash, Blytheville, Ark.	Late 1939	F-50	700 hr.	660 hr.	925
W. A. Crews, 1201 W. Ash, Blytheville, Ark.	Late 1939	Lyc. 50	650 hr.	50 hr.	925
Paul D. Eyster, Tri-State Arpt., Angola, Ind.	J-3	Frnkln. 60	210 hr.	none	925
W.Va. Air Serv., Box 401. County Arpt., Clarksburg, W.Va.	J3F	Frnkln. 50	220 hr.		925
Somerset Hills Arpt., Basking Ridge, N. J.	J3L	Lyc. 55	850 hr.	750 hr.	925
Ray Wilson, Park Hill Arpt., Denver, Colo.	J3F	Frnkln. 50	972 hr.	62 hr.	900
Ray Wilson, Park Hill Arpt., Denver, Colo.	J3F	Frnkln. 50	1040 hr.	116 hr.	900
Red Bank Arpt., Inc., Red Bank, N. J.	J3	Cont. 50	975 hr.	85 hr.	900
Pekrul's Fly. Serv., Traverse City Arpt., Mich.	J-3-F	Frnklin	1010 hr.	370 hr.	900
Paul D. Eyster, Tri-State Arpt., Angola, Ind.	J-3	Frnkln. 60	275 hr.	none	900
L-H Air Serv., Hatboro Airport, Hatboro, Pa.	J-3	Lyc. 55	750 hr.	500 hr.	900
Hawthorne Fly. Serv., Mun. Arpt., Charleston S. C.	J-3	Frnkln. 50	800 hr.		900
Decatur Avia. Co., 776 S. Maffit St., Decatur, Ill.	J3F	Frnkln. 50	1020 hr.		900
Seidner Fly. Serv., S.A.M. Arpt., Youngstown, Ohio	J-3	Frnkln. 50	235 hr.	1940 model	900
Ellis Eugene Eno, Eno Arpt., Fort Dodge, Iowa	Coupe '39	Cont. 65	450 hr.	recently	900
Staff. Rogers, Box 599, Wewoka, Okla.	J3	Frnkln. 50	800 hr.	600 hr.	900
Va. Cub Dis., Inc., Box 211, Farmville, Va.	Trainer	Frnkln. 50	800 hr.	700 hr.	900
Southern Air Serv., Memphis, Tenn.		Lyc. 50	300 hr.	new	900
Gerald W. Richardson, Port Erie Arpt., Erie, Pa.	J3F	Frnkln. 60	300 hr.	200 hr.	895
Gerald W. Richardson, Port Erie Arpt., Erie, Pa.	J3F	Frnkln. 60	675 hr.	no	895
John P. Hall, West Haven Arpt., West Haven, Conn.		Cont. A-50	600 hr.	recently	895
J. C. Gendron, Ironwood, Mich.	Sport J3	Frnkln. 50	325 hr.	50 hr.	895
Louisville Fly. Serv., Bowman Fld., Louisville, Ky.	J3F-60	Frnkln. 60	545 hr.	none	895
Louisville Fly. Serv., Bowman Fld., Louiville, Ky.	J3-F60	Frnkln. 60	574 hr.	none	895
Somerset Hills Arpt., Basking Ridge, N. J.	J3L	Lyc. 50	900 hr.	750 hr.	890
McInnis Avia. Serv., Minn. Munic. Arpt., Minn., Minn.	Cub J3	Frnkln. 50	340 hr.	new	875
Bennett Air Serv., P.O. Box 247, Hightstown, N. J.	Cub Train. Dual Frnkln. 50 J-3	2 Bendix Mags.	371 hr.	½ hr. since overhaul	875
The Hudson Valley Aircr., 68 Dolson Ave., Middletown, N. Y.	J3 Trainer 40 Piper	Frnkln. 50	400 hr.	9/40	875
W. B. Skelton, Greenv. Arpt., Greenv., Pa.	J3	Lyc. 50	650 hr.	Nov. '40	875
J.C. Gendron, 208 W. Aurora St., Ironw., Mich.	Sport	Frnkln. 50	530 hr.	525 hr.	875
Skelly's Fly. Serv., Greenville Arpt., Grnv., Pa.	J-3	Lyc. 50	675 hr.	50 hr.	875
Frank Rensma, Box 441, Youngsville, Pa.	J3	Frnkln. 50	620 hr.	560 hr.	850
John Ruzicka, Circus City Arpt., Peru, Ind.	J3 '39	Frnkln. 50	1400 hr.	250 hr.	850
Jenkins Air Serv., Munic. Arpt., Rochester, N.Y.	Trainer Cub	Lyc. 50	1000 hr.	700 hr.	850
Paul D. Eyster, Tri-State Airpt., Angola, Ind.	Cub J3	Frnkln. 50	450 hr.	none	850
Fayette Airways, Connellsville Arpt., Uniontown, Pa.	Cub J3	Frnkln. 55	715 hr.	12/15/40	850
Fayette Airways, Connellsville Arpt., Uniontown, Pa.	Cub J3	Lyc. 50	650 hr.	12/15/40	850
L-H Air Serv., Hatboro Arpt., Hatboro, Pa.	J3	Frnkln. 50	750 hr.	500 hr.	850
Ellis Eugene Eno, Eno Arpt., Fort Dodge, Ia.	Cub Coupe	Cont. 65	425 hr.	recent	850
Sky Sport, Inc., Cincinnati Arpt., Sharonville, O.	J350	Frnkln. 50	436 hr.	will	850
Hylan Fly. Serv., Rochester Arpt., Roch., N. Y.	J-3	Lyc. 50	1050 hr.	Aug. '40	850
Stafford Rogers, Box 599, Wewoka, Okla.	J3	Frnkln. 50	1100 hr.	800 hr.	850
Va. Cub Dis., Inc., Box 211, Farmv., Va.	Trainer	Cont. 50	400 hr.	300 hr.	850
T. Metcalf, Toledo Mun. Arpt., Toledo, O.	J3F	Frnkln. 60	600 hr.	520 hr.	850
Chi. Avia. Corp., Palwaukee Arpt., Mt. Pros., Ill.	J3L	Lyc. 50	1000 hr.	200 hr.	850
Ranger Flyg. Serv., Ranger, Texas	J3F	Frnkln. 50	775 hr.	July '40	825
Bill LePine, Tri-City Arpt., Endicott, N. Y.	Cub J3	Lyc. 50	1400 hr.	1100 hr.	800
Louis A. Musgrove, Box 814, Morgantown, W. Va.	J3	Lyc. 50	650 hr.	200 hr.	800
Fayette Airw., Connellsville Arpt., Uniontown, Pa.	Cub J3	Lyc. 50	740 hr.	12/15/40	800
Akron Airw., Inc., Arpt., Akron, Ohio		Lyc. 50	800 hr.	200 hr.	800
Ramnells Air Serv., Arpt., Cumberland, Md.	J3	Frnkln. 50	600 hr.	no	800
Ranger Flyg. Serv., Ranger, Texas	J3F	Frnkln. 50	1000 hr.	Apr. '40	800
Ranger Flyg. Serv., Ranger, Texas	J3F	Frnkln. 50	775 hr.	May '40	800
Susquehanna Air Serv., Montoursville, Pa.	J-3	Lyc. 55	950 hr.	600 hr.	795
Skelly's Fly. Serv., Greenville Arpt., Greenville, Pa.	J-3	Lyc. 50	800 hr.	25 hr.	795
Seaboard Air Trans., Lumberton Arpt., Lumb. N. C.		Cont. 50	450 hr.	just	795
Howard G. Mayes, Box 2104, Huntington, W. Va.	J-3	Cont. 50	900 hr.		785
L. H. Melter, Solon Arpt., Solon, Ohio	J3	Cont. A40	350 hr.	300 hr.	795
Howard G. Mayes, Box 2104, Huntington, W. Va.	J-3	Frnkln. 50	1000 hr.	50 hr.	785
Bob Howe, Gardner Arpt., Gardner, Mass.	Late '39 Cub J3	Cont. 40 hp.	130 hr.		775
T. Metcalf, Toledo Munic. Arpt., Toledo, Ohio	J3F	Frnkln. 50	1170 hr.	220 hr.	775
Ben C. Arquitt, Munic. Arpt., Lima, Ohio	Cub J3 '39	Frnkln. 50	678:20	556:15	750
Sky Sport, Inc., Cincinnati Arpt., Sharonville, O.	J350	Frnkln. 50	655 hr.	will	750
Akron Airw., Inc., Arpt., Akron, Ohio		Cont. 50	320 hr.		750
Ranger Flyg. Serv., Ranger, Texas	J3F	Frnkln. 50	1100 hr.	Jan. '40	750
Bennett Air Serv., P.O. Box 247, Hightstown, N. J.	Cub Trainer	J3 Frnk. 50	703 hr.	Eng. time 48 min.	725
Ellis Eugene Eno, Eno Arpt., Fort Dodge, Ia.	Cub Trainer '39	Lyc. 50	1000 hr.	recent	725

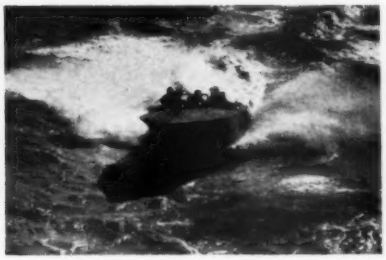
DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	J-2	Cont.	700 hr.	60 hr.	$700
Piedmont Avia., Box 41, Winston-Salem, N. C.	Cub J-3	Cont. 40	496 hr.	76 hr. ago	700
C. R. Galloway, 3006 Hardi, Ft. Smith, Ark.	Sport	Cont. 40	450 hr.	recent	700
Johnny Haralson, Air Trans. & Sales Co., Toney Field, Pine Bluff, Ark.	Cub J-3	Cont. A-44	650 hr.	600 hr.	695
Woodlawn Balto Co., Baltimore, Md.	J-3	Cont. 40	376 hr.	120 hr.	695
Edwards Fly. Serv., Flushing Arpt., Flushing, L. I.	Cub J-3	Cont. 40	930 hr.	875 hr.	675
Calkins Arcft., 1022 N. Atlantic, Seattle, Wash.		Cont. 40	800 hr.	17 hr.	675
Oakland Arcft., Alameda, Cal.	J-2	Cont. 40	1785 hr.	May '40	665
McInnis Avia. Serv., Minn. Avia. Serv., Minn., Minn.	Cub J2	Cont. 40	930 hr.	4 hr.	650
Utah Pacific Airwys., Inc., Box 1187, Ogden,	U.J3	Cont. 40	1500 hr.	now	650
Calkins Arcft., 1022 N. Atlantic, Seattle, Wash.		Cont. 40	1467 hr.	138 hr.	650
Boulevard Arpt., Inc., Roosevelt Blvd., & Red Lion Rd., Philadelphia, Pa.	Cub J2	Cont. 40 hp.	500 hr.	250 hr. since over-haul	625
Calkins Arcft., 1022 N. Atlantic, Seattle, Wash.	J-2	Cont. 40	854 hr.	263 hr.	625
Wenatchee Air Serv., R.F.D. No. 4, Wenatchee, Wash.	Cub J2	Cont. A40	975 hr.	20 hr. ago	600
Blvd. Arpt., Inc., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	Cub J2	Cont. 40 hp.	250 hr.	100 hr. since over-haul	600
R. E. Lee, Munic. Arpt., Rocky Mount, N. C.	J2	Cont. A40-4	520 hr.	8/40	600
Clinton Arpt., Elliott Fly. Serv., DeWitt, Ia.	J2	Cont. 40	900 hr.	100 hr.	600
W. B. Jones, Arpt., Marlboro, Mass.	J2	Cont. 40		50 hr.	600
Carolina Aircraft Sales, Munic. Arpt., Charlotte, N. C.	J2	Cont. 40	900 hr.	850 hr.	600
Phillip A. Meinke, Route No. 3, Willo., Ohio.	J2	Cont. A40	479 hr.	re-cov'd	550
Ramnells Air Serv., Arpt., Cumberland, Md.	J2	Cont. 40	500 hr.	50 hr.	550
Rocky Mt. Fly. Serv., Mun. Arpt., Ry. Mt., N. C.	J2	Cont. A40-4	450 hr.	Sept.'40	550
C. W. Peterson, Pet. Fly. Serv., Salina, Kansas	J2	Cont. 40	588 hr.	558 hr.	550
Bill LePine, Tri-Cities Arpt., Endicott, N. Y.	Cub J2	Cont. A-40-5 Dual	900 hr.	800 hr.	525
Krantz Aeronautical Serv., Port Erie, Erie, Pa.	J-2	Cont. A40	350 hr.	75 hr.	525
Louisville Fly. Serv., Inc., Bowman Fld., Louisville, Ky.	J3	Cont. 40	672 hr.	162 hr.	525
New Mex. Fly. Serv., Box 67, Clovis, N. M.	Cub Trainer	Cont. 40 hp.	700 hr.	now	510
John Ruzicka, Circus City Arpt., Peru, Ind.	Cub J-2 '37	Cont. 40	310 hr.	10 hr.	500
Krantz Aeronautical Serv., Port Erie, Erie, Pa.	J-2	Cont. A40	650 hr.	150 hr.	500
Aviation Service, Hartford, Conn.	E-2	Cont. 40	998 hr.	283 hr.	500
Aviation Service, Hartford, Conn.	E-2	Cont. 40	323 hr.	285 hr.	500
PITCAIRN					
Blvd. Arpt., Inc., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	PA-7	Wright 240	450 hr.	no	1800
PORTERFIELD					
Falcon Aircr. Corp., L. A. Munic. Arpt., Inglewood, Cal.	1937	Warner 90			1250
Speed's Flyg. Serv., Holmes Arpt., Jackson Hts., N. Y.		Cont. 50	105 hr.		1200
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	CP50	Cont. 50	350 hr.	250 hr.	1095
Bethany Air Serv., Inc., Amity Rd., Bethany, Conn.		LeBlond	178 hr.		900
Baker-Eberle Avia. Co., City Arpt., Detroit, Mich.		LeBlond 70	485 hr.	400 hr.	850
Doug Schall, 33 Claggatt Rd., Hyattsville, Md.	Zephyr	40 hp.	300 hr.		575
REARWIN					
Doug Schall, 33 Claggatt Rd., Hyattsville, Md.	Cloudster	120 hp. Ken Royce	55 hr.		3675
C. Evers, 247 Park Ave., N.Y.C.		Warner 90	138 hr.	none	2250
Cape Aircraft, Inc., Falmouth Arpt., Hatch, Mass.	Sportster	LeBlond 90	340 hr.	newly	1350
Dawson Air Serv., Box 852, Salina, Kans.	9000L	LeBlond 90	Eng. 235 hr.	20 hr.	1275
Falcon Aircr. Corp., L.A. Munic. Arpt., Inglewood, Cal.	Sportster '39	70 LeBlond			1100
Jennings Bros., No. Grafton, Mass.		LeBlond 70	680 hr.	50 hr.	1075
Utah Pacific Airways, Inc., Box 1187, Ogden, U.		LeBlond 85	1100 hr.	900 hr.	1050
Four Lakes Avia. Corp., Royal Arpt., Madison, Wis.	7000	LeBlond 70	225:25 hr.		1050
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	8500	LeBlond 85	650 hr.	just	950
P. A. Meinkie, Route No. 3, Willo., Ohio.	8500	LeBlond 85	900 hr.	being o.	950
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	Sportster	LeBlond 70	900 hr.	50 hr.	900
Falcon Aircr. Corp., L.A. Munic. Arpt., Inglewood, Cal.	Sportster	LeBlond			850
Racine Fly. Serv., Racine Arpt., Racine, Wisc.	7000	LeBlond 70	528 hr.	528 hr.	850
Neal McCray Arpt., Jamestown, N. Y.	1936	LeBlond 70	850 hr.	700 hr.	695
ROBIN					
Al Gillis Fly. Serv., Great Falls, Mont.	OX5	OX5	575 hr.	Oct. '40	895
Red Bank Arpt., Red Bank, N. J.		Challenger 185	395 hr.	150 hr.	650
Weymouth Haver, Lebanon, N. J.		Challenger 185		Dec. '39	475

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
RYAN					
Galvin Fly. Serv., Boeing Fld., Seattle, Wash.	B-5	Wright 330	3700 hr.	100 hr.	$1350
O'Neal Aircraft Co., O'Neal Arpt., Vincennes, Ind.	B1	J-5	950 hr.	800 hr.	795
SECURITY					
Avia. Serv. Co., Brainard Fld., Hartford, Conn.	S1A	Kinner K-5 100 hp.	1043 hr.	303 hr.	850
SIKORSKY					
E. W. Wiggins Airways, Inc., Providence, R. I.	S-39	Wasp 450	700 hr.	recently	6000
Carl Evers, 247 Park Ave., N. Y., N. Y.	Amphibian 5 pl	Pratt Whitney Wasp Jr. 300 hp.			3800
Muncie Avia. Corp., Muncie Arpt., Muncie, Ind.	S-39	300 h.p. Pratt-Whitney	465 hr.	55 hr.	3750
SPARTAN					
Aero Brok. Serv., Metro. Arpt., Van Nuys, Cal.	C3	Wright 175	580 hr.	241 hr.	1000
Spartan Sch. of Aeron., Box No. 2551, Tulsa, Okla.	C-3	Wright J6-7	506 hr.	not re-built	900
Spartan Schl. of Aeron., Box No. 2551, Tulsa, Okla.	C-3	Wright J6-5	2091 hr.	26 hr.	850
Spartan Schl. of Aeron., Box No. 2551, Tulsa, Okla.	C-3	Wright J6-5	1443 hr.	1008 hr.	700
Spartan Schl. of Aeron., Box No. 2551, Tulsa, Okla.	C-3	Wright J6-7	926 hr.	not rebuilt	750
SPORTWING					
Oakland Aircraft, Alameda, Calif.		Kinner 125	640 hr.	Jan. '40	2400
STANDARD					
O'Neal Aircraft Co., O'Neal Arpt., Vincennes, Ind.		J-5	700 hr.	650 hr.	1195
A. A. Knowles, Rt. 4, Boise, Ida.	New	Wright J 5,220	417 hr.	3-15-40	1000
H. P. Grim, Jr., R.F.D. No. 4, Staunton, Va.		Kinner B5	1259 hr.	80 hr.	850
Blvd. Arpt., Inc., Roosevelt Blvd. & Red Lion Rd., Philadelphia, Pa.	New D-29	Kinner 100 hp.	1300 hr.	no	700
STINSON					
Chi. Avi. Corp., Curtiss Arpt., Glenview, Ill.	Reliant SR8E	Wright 350	275 hr.	80 hr.	5750
Thomas Oakes, 240 Belleville Ave., Bloomfield, N. J.	SR9BD	Lyc. 245	620 hr.	350 hr.	4500
Leech Aircraft, Inc., Roosevelt Fld., Mineola, N. Y.	SR-9D	Wright 285			3900
Lynchburg Air Trans. & Sales Corp., Preston Glenn Arpt., Lynchburg, Va.	SR7	Lyc. 245 hp.	700 hr.	25 hr.	3500
Leech Aircraft, Inc., Roosevelt Fld., Mineola, N.Y.	105	Cont. 80	54 hr.	none	3465
George C. Haven, Schenectady City Arpt., Schenectady, N. Y.	105	Cont. 80 Starter	200 hr.	no	3100
Indiana Air Serv., Bendix Fld., So. Bend, Ind.	SR 7C	Lyc. 265	1600 hr.	1500 hr.	3000
Seaboard Air Transport, Lumberton, N. C.	SR-6	Lyc. 225	298 hr.	190 hr.	3000
Inter-City Airlines, Inc., Boston Munic. Arpt., East Boston, Mass.	"105"	Cont. 80	50 hr.		2975
Franklin Rose Aircr., Bay Airdrome, Alameda, Cal.	105	Cont. 80	275 hr.		2950
Pete Grim, R.F.D. No. 4, Staunton, Va.	105	Cont. 80 h.p.	250 hr.	none	2895
Al Gillis Fly. Schl., Great Falls, Mont.	SR6	245 Lyc.	575 hr.	125 hr.	2850
Leech Arcft., Inc., Roosevelt Field, Mineola, N.Y.	105	Cont. 80	182 hr.	none	2880
Air Service, Mun. Arpt., Denver, Colo.	105	Cont. 80	240 hr.	40 hr.	2800
J. A. Atherton, Arpt., Rochester, Minn.	105	Cont. 80 hp.	95 hr.	no	2750
Pacific Dis. Corp., 1321 Flower St., Glen., Cal.	105	Cont. 75	10 hr.	no	2750
Chi. Avi. Corp., Curtiss Arpt., Glenv., Ill.	SR5B	Lyc. 245	1000 hr.	100 hr.	2665
Jenkins Air Serv., Munic. Arpt., Rochester, N.Y.	105	Cont. 80	175 hr.		2650
Edwards Fly. Serv., Flush. Arpt., Flushing, L. I.	105	Cont. 80	400 hr.	320 hr.	2600
Sioux Skyw., Inc., Muni. Arpt., Si. Falls, S. D.	105	Cont. 80	210 hr.		2500
Johannesson Fly. Serv., Stevenson Arpt., Win., Can.	SM2A	J6-5-175	1750 hr.	May '39	2500
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	SR5-A	Lyc. 245	810 hr.	750 hr.	2495
Leech Arcft., Inc., Roosevelt Field, Mineola, N.Y.	105	Cont. 75	545 hr.	160 hr.	2450
John K. Hinson, Rutherford Arpt., Balti., Md.	SR6	Lyc. 225	1070 hr.	230 hr.	2395
Baker-Eberle Avia. Co., City Arpt., Detroit, Mich.	105	Cont. 75	340 hr.	not kn.	2325
Chi. Avi. Corp., Curtiss Arpt., Glenvi., Ill.	105	Cont. A75	400 hr.	20 hr.	2275
Colo. Avia. Co., 426 U.S. Natl. B.B., Denver, Colo.	105	Cont. 175	210 hr.	yes	2250
P. J. Sones, Co., Haines City, Fla.	105	Cont. 75	230 hr.	none	2250
Safair, Inc., Roosevelt Fld., Mineola, N. Y.	SR-6	Lyc. 225	80 hr.		2200
P. J. Sones, Co., Haines City, Fla.	SR-6B	Lyc. 245	590 hr.	190 hr.	2200
Susquehanna Air Serv., Montoursville, Pa.	SR-5	Lyc. 245	920 hr.	650 hr.	2050
Northern Okla. Fly. Serv., P.O. Box 556 Blackwell, Okla.	SR5E	Lyc. 225	950 hr.	350 hr.	2000
Walter D. Mauk, Municipal Arpt., Blackwell, Okla.	SR 5E	Lyc. 225	950 hr.	engine	2000
Aero-Way's, Inc., Mun. Arpt., Cleveland, O.	SR 5	Lyc. 325	409 hr.	350 hr.	1850
Franklin Rose Aircr., Bay Airdrome, Alameda, Cal.	SR5C	Lyc. 260	2500 hr.	8 hr.	1800
Matthews & Rap, Roosev. Fld., Mineola, N. Y.	Sr.-Jr.	Lyc. 215	550 hr.	Aug. '40	1800
St. Louis Fly. Serv., Lambert Fld., Robertson, Mo.	JRSR	Lyc. R680 215 hp.	1065 hr.	recently	1750
Pacific Dis. Corp., 1321 Flower St., Glen., Cal.	SM6000B	3 Lyc. 215	5918 hr.	735 hr.	$1750
Moberly Fly. Serv., 605 Concannon St., Moberly, Mo.	1933SR	Lyc. 215	1250 hr.	1200 hr.	1350
Akron Airways, Arpt., Akron, Ohio.	SR	Lyc.	850 hr.	350 hr.	1350
Akron Airw., Arpt., Akron, Ohio.		Lyc. 215	1200 hr.	315 hr.	1300
Chi. Avi. Corp., Palwaukee Arpt., Mt. Pros., Ill.	SR	Lyc. 215	1000 hr.	500 hr.	1295
Huron Fly. Serv., Box 415, Huron, S. D.	SM8A	Lyc. 215	1900 hr.	8-20-40	1100
Seaboard Air Trans., Lumberton, N. C.	R	Lyc. 215	750 hr.	350 hr.	1100
R. F. Turner, Airport, Spartanburg, S. C.	S	Lyc. 680	800 hr.	150 hr.	1150
Springfield Avia. Co., Munic. Arpt., Springfield, Ill.	SM-8A	Lyc. 215	760 hr.	360 hr.	1075
Four Lakes Avia. Corp., Royal Arpt., Madison, Wis.	SM-2AA	Wright 175	543:50	516:45	1050
Fox Valley Fly. Serv., Arpt., Aurora, Ill.	S	Lyc. 215	965 hr.	791 hr.	1050
Falcon Aircr. Corp., L. A. Mun. Airpr., Inglewood, Cal.	SM 2AB	Wright J5			950
Maheux's Airpr., Inc., Stevens Mill Rd., Auburn, Me.	SM8A	Lyc. 215h.p.			950
Barr Aviation Corp., Detroit, Michigan.		Lyc. 215	890 hr.	5hr.eng.	950
Tri Cities Avia. Sch., Tri Cities Airpr., Endicott, N. Y.	SM8A	Lyc. 215	1500 hr.	1300 hr.	900
Jesse Jones Mun. Arpt., Lancaster, Penna.	SM 8A	Lyc. 225	800 hr.	200 hr.	900
St. Louis Fly. Serv., Lamb. Fld., Robertson, Mo.	SM1F	Wright 330 h. p.	815 hr.	recently	895
Decatur Avia. Co., 776 S. Maffit St., Decatur, Ill.	SM1F	Wright J69 330 h. p.	850 hr.	220 hr.	895
Midwest Av. Sales, Stinson Arpt., LaGrange, Ill.	SM8A		2025 hr.	yes	800
Leeward Aircraft, New Kensington, Pa.		Lyc. 215	900 hr.	250 hr.	795
Aero Brokerage Serv., Metro Arpt., Van Nuys, Calif.	SM1	Wright J-5 220 h. p.	1870 hr.	120 hr.	725
P. A. Meinke, Route No. 3, Willo., Ohio	SM-2	War-Sca-125		100 hr.	500
TAYLORCRAFT					
Walter D. Mauk, Mun. Arpt., Blackwell, Okla.		Cont. 65	19 hr.	new	1950
Narragan. Avi. Serv., R.I. State Arpt., Hills, R.I.	DeLux	Cont. 65	202 hr.		1895
Fox Valley Fly. Serv., Arpt., Aurora, Ill.	DeLuxe	Cont. 65	138 hr.	none	1850
Frantz Fly. Serv., Box 2504, Roanoke, Va.	40	Cont. 65	350 hr.		1800
Narragan. Avi. Serv., R.I.State Arpt., Hills, R.I.	DeLux	Cont. 65	308 hr.		1795
Dufort School of Aeron., Malone, N. Y.	BC	Cont. 65	300 hr.	new 5-1-40	1775
A. J. Moore, 324 State St., Baden, Pa.	B2	Cont. 65	95 hr.		1750
Springfield Avia. Co., Mun. Airp., Spring, Ill.	BC-65	Cont. 65	190 hr.		1750
Franklin Rose Aircrft, Bay Aird, Alameda, Cal.	BC-65	Cont. 65	175 hr.		1750
C. R. Galloway, 3006 Hardie, Ft. Smith, Ark.	DeLux	Cont. 65	210 hr.	none	1750
Moline Fly. Serv., Mun. Airp., Moline, Ill.	BC-65	Cont. 65	650 hr.		1650
Roscoe Turner Aeron., Indianapolis, Ind.	DeLuxe BC	Cont. 65	305 hr.	Top.Reg.	1650
Washington Pk. Arpt., Homewood, Ill.		Cont. 65	150 hr.	none	1650
Clinch Fly. Serv., Mun. Arpt., N. Pl., Neb.	B	Lyc. 65	1000 hr.	800 hr.	1600
Colo. Avia. Co., 426 U.S.Natl. BB, Denver, Col.	BC-65	Cont. 65 Dual	400 hr.	yes	1575
McInnis Avia. Serv., Minneapolis, Mun. Airpt., Minneapolis, Minn.	BL65	Lyc. 65	65 hr.	new	1550
Moline Fly. Serv., Mun. Airp., Moline, Ill.	BL-65	Lyc. 65 Seaplane	505 hr.	none	1550
Dewey Eldred Fly. Serv., Lost Nation Rd., Willoughby, Ohio		Cont. 65	302 hr.		1550
Bob Howe, Gardner Airp., Gardner, Mass.	BC1940	Cont.65h.p.	168 hr.		1500
Hubert & Dillon Air. Serv., Inc., Box 177-S, Tacoma, Wash.	39	Cont. 65	450 hr.		1500
Charles Feris, Hillside, Ill.		Lyc. 65	225 hr.		1500
Ben A. Funk, Hy. No. 50, Grover, Mo.		Lyc. 65	30 hr.	since new	1495
Merrill Hale, Hillsgrove, R. I.		Cont. 65	490 hr.		1495
Glens Falls Fly. Serv. Airp., Glens Falls, N. Y.	DeLuxe BC	Cont. 65	475 hr.	450 hr.	1475
Fox Valley Fly. Serv., Arpt., Aurora, Ill.	Trainer	Lyc. 65	60 hr.	none	1475
W. B. Jones, Arpt., Marlboro, Mass.		Lyc. 65	262 hr.		1475
C. R. Galloway, 3006 Hardie, Ft. Smith, Ark.	Deluxe	Lyc. 65	625 hr.	recent Major	1475
Moline Fly. Serv., Mun. Airp., Moline, Ill.	BL-65	Lyc. 65	165 hr.	none	1450
Inter City Fly.Serv., Mun.Arpt.,Ft.Wayne, Ind.	Deluxe Craft	Cont. 65	550 hr.		1450
W. B. Jones, Arpt., Marlboro, Mass.		Lyc. 55	210 hr.		1450
Inter City Fly.Serv.,Mun.Arpt.,Ft.Wayne, Ind.		Lyc. 50	177 hr.		1425
Dufort Schl. of Aero., Malone, N. Y.	BL	Lyc. 55	100 hr.	new 10/40	1400
Duane L. Huscher, Box 65, Lawton, Okla.	BC	Cont. 65	1100 hr.	500 hr.	1400
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	85 hr.	none	1390
Dewey Eldred Fly. Serv., Lost Nation Rd., Willoughby, Ohio		Lyc. 65	116 hr.		1375
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 50	104 hr.	none	1375
Marlboro Airp., Farm Rd., Marlboro, Mass.	Model B	Lyc. 65 Dual 16N	365:10	none	1350
Walter D. Mauk, Mun. Arpt., Blackwell, Okla.	Blt. 50	Lyc. 50	160 hr.	new Aug.	1350
Northern Okla. Fly. Serv., P. O. Box 556, Blackwell, Okla.		Lyc. 50	275 hr.		1300
Dewey Eldred Fly. Serv., Lost Nation Rd., Willoughby, Ohio		Seaplane Lyc. 65	600 hr.	just Maj. just Relicens	1300
J. E. Badger, 1780 Green Rd., So. Euclid, O.	BC '39	Cont. 65	145 hr.	top 10/5	1300
Washington Pk. Arpt., Inc., Homewood, Ill.		Lyc. 55	235 hr.	none	1295
Ryan Air Serv., Decorah, Ia.		Lyc. 50	295 hr.		1250
Four Lakes Avia. Corp., Royal Arpt., Madison, Wis.	Deluxe BL	Lyc. 65	469 hr.	363 hr.	1235
Howard Fly. Serv., Box 565, Ames, Iowa.	BL	Lyc. 65	675 hr.	100 hr.	1200

FLYING and POPULAR AVIATION USED PLANE LISTING OF AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	OVER-HAULED	PRICE
Dufort Sch. of Aeron., Malone, N. Y.	BL	Lyc. 55	250 hr.	5/1/40	$1200
Avia. Serv. Co., Brainard Fld., Hartford, Conn.	BL	Lyc. 55	255 hr.		1200
Ryan Air Service, Decorah, Iowa	BL	Lyc. 50	450 hr.	375 hr.	1200
O'Neal Aircraft Co., O'Neal Airport, Vincennes, Ind.		Lyc. 55	450 hr.	no	1200
Clinch Fly. Serv., Mun. Arpt., N. Pl., Nebr.	B	Lyc. 50	700 hr.	yes	1200
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.		Lyc. 50 h.p.	700 hr.	100 hr.	1175
Bob Howe Gardner Airp., Gardner, Mass.	BL	Lyc. 50 h.p.	44 hr.		1150
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.		Lyc. 50 h.p.	925 hr.	900 hr.	1150
Fred Helm, Zap, No. Dakota	B.F.	Frnklin. 50	295 hr.		1150
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	39	Lyc. 50 h.p.	1185 hr.	Nov. '40	1150
H. C. Phillips, Arpt., Mt. Pleas., Mich.		Lyc. 50	700 hr.	650 hr.	1150
H. C. Phillips, Arpt., Mt. Pleas., Mich.		Lyc. 50	950 hr	950 hr.	1150
Northern Okla. Fly. Serv., P. O. Box 556, Blackwell, Okla.		Frnklin. 50	300 hr.		1100
Howard Fly. Serv., Box 565, Ames, Iowa	BL	Lyc. 50	800 hr.	just	1100
Art Whitaker Portland Airp., Portland, Ore.		Lyc. 55	1100 hr.	1100 hr.	1075
Narragan. Avi. Serv., R.I. State Arpt., Hill,R.I.		Cont. 50	600 hr.	540 hr.	1075
Louis A. Musgrove, Box 814, Morgantown, W. Va.	BL50	Lyc. 50	550 hr.	now	1050
Oscar L. Hostetter, York Arpt., Thomasville,Pa.	BL-T	Lyc. 50	550 hr.	none	1050
Merrill Hale, Hillsgrove, R. I.		Frnklin. 50	268 hr.	35 hr.	1050
John P. Hall, West Haven Airp., West Haven, Conn.	B	Lyc. 50	400 hr.	new	1045
Duane L. Huscher, Box 65, Lawton, Okla.	BF	Frnklin. 50	1200 hr.	100 hr.	1025
W. A. Crews, 1201 W. Ash, Blytheville, Ark.	Late '39	Lyc. 65	500 hr.	Major Notime	1000
Palmetto Air Schl.,Mun.Airp.,Spartanburg,S.C.	BL	Lyc. 50			1000
Palmetto Air Schl.,Mun.Airp.,Spartanburg,S.C.	BL	Lyc. 65			1000
Palmetto Air Schl.,Mun.Airp.,Spartanburg,S.C.	BL	Lyc. 50			1000
Palmetto Air Schl.,Mun.Airp.,Spartanburg,S.C.	BL	Lyc. 50			1000
Johannesson Fly. Serv., Stevenson Arpt., Winnipeg, Can.	A	Cont. 40-3	1300 hr.	Dec. '39	995
Inter-City Flyg. Serv.,Mun.Arpt.,Ft.Wayne,Ind.		Frnklin. 50	625 hr.	500 hr.	980
Louis A. Musgrove, Box 814, Morgantown, W. Va.	BL-T	Lyc. 55	700 hr.	200 hr.	950
Piedmont Avia.,Bx. 1941,Winston-Salem,N.C.	'39	Frnklin. 50	543 hr.	43 hr. ago	950
Dewey Eldred Fly. Serv., Lost Nation Rd., Willoughby, Ohio.		Lyc. 55	372 hr.		950
Port Columbus Fly. Schl., Port Columbus, Columbus, Ohio.		Lyc. 50	975 hr.	yes	950
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	'38	Cont. A-40-A	1100 hr.	Nov. '40	895
Jersey Fly. Serv., Oakland, N. J.	BF	Frnklin. 50	800 hr.	none since rebuilt	875
Dufort Schl. of Aeron., Malone, N. Y.	BF	Frnklin. 50	750 hr.	being ov'rhaul	875
Jesse Jones, Mun. Arpt., Lancaster, Pa.	B C	Cont. 50	300 hr.	none	800
Jesse Jones, Mun. Arpt., Lancaster, Pa.	1939	Cont. 50	400 hr.	50 hr.	800
Jennings Bros., No. Grafton, Mass.		Cont. 40	660 hr.	100 hr.	800
Stinson Flyg. Corp., Glendale, Calif.		Cont. 40	1100 hr.	170 hr.	760
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	Mod. A '38	Cont. A-40	900 hr.	140 hr.	750
Ryan Air Service, Decorah, Iowa		Cont. 40	326 hr.		750
Orangeburg Fly. Serv., Inc., Box 250, Orangeburg, S. C.	"A"	Cont. 40	500 hr.	100 hr.	750
Reifenberg Avia., Inc., St. Johns, Pa.	Mod. A '38	Cont. A-40-4	275 hr.	25 hr.	750
Ryan Air Service, Decorah, Ia.		Contl 40	326 hr.		750
Orangeburg Fly. Serv., Box 250, Orangeburg, S. C.	"A"	Cont. 40	500 hr.	100 hr.	725
Sweet Fly. Serv., Visalia Mun. Arpt., Vis., Cal.	A	Cont. 50	839 hr.	100 hr.	725
Duane L. Huscher, Box 65, Lawton, Okla.	A	Cont. A40	1000 hr.	700 hr.	700
B. F. Sponamore, 710 S St., Dodge City, Kans.	Model A	Cont. A40-4	600 hr.		700
A. R. Smith, Mun. Arpt., Aberdeen, Miss.		Cont. 40	750 hr.	Oct. 1st	700
Carnahan Flyg. Serv., Bloomington, Ill.		Cont. 40	507 hr.	100 hr.	700
Clinch Fly. Serv., Mun. Arpt., N. Pl., Nebr.	A	Cont. A40	850 hr.	700 hr.	700
Merrill Hale, Hillsgrove, R. I.		Cont. 40	1081 hr.	100 hr.	695
Springfield Avia. Mun. Airp., Springfield, Ill.	1937	Cont. A-40	375 hr.		650
Utah Pacific Airways, Inc.,Box 1187,Ogden,U.		Cont. 40	1200 hr.	1050 hr.	650
Reifenberg Avia., Inc., St. Johns, Pa.	A1938	Cont. A40-4	450 hr.	22 hr.	650
Whicker Fly. Serv., Mun. Arpt., Ft. Wayne,Ind.		Cont. 40	750 hr.	60 hr.	650
Fox Valley Fly. Serv., Arpt., Aurora, Ill.	1937	Cont. A-40	865 hr.	now	650
Sky Sport, Inc., Cincinnati Arpt., Sharonville,O.		Cont. 40	975 hr.	800 hr.	650
R. E. Lee, Mun. Arpt., Rocky Mount, N. C.		Cont. 40	465 hr.	9/40	650
J. L. Wells, 106 W. Main, Avon Park, Fla.		Cont. 40	690 hr.	100 hr.	650
H. G. Phillips, Arpt., Mt. Pl., Mich.		Cont. 40	700 hr.	600 hr.	650
Jersey Fly. Serv., Oakland, N. J.	A	Cont. A40	595 hr.	none since rebuilt	625
Chas. Ferris, Hillside, Ill.	A	Cont. A40	900 hr.	750 hr.	575
Cape Aircraft, Inc., Falmouth Arpt., Hatchville, Mass.	Model A	Cont. A-40	340 hr.	just	550
Hobl-May Air Serv., N. O. Arpt., New Or., La.	A	Cont. 40	1000 hr.	150 hr.	500
TRAVELAIR					
Falcon Aircraft Corp., L. A. Mun. Arpt., Inglewood, Cal.	Osprey	Wright 250	814 hr.	1¾ hr.	2750
E. W. Wiggins Airways, Norwood, Mass.		S-6000-B	1000 hr.	recently	1600
Lynchburg Air Trans. & Sls., Preston Glenn Arpt., Lynchburg, Va.	4000	Wright J5 225 h. p.	800 hr.	now	1500
J. S. Barham, Arpt., Santa Rosa, Cal.	12W2002	War-Scarab 125 h.p.	2000 hr.	5-20-40	1450
Aero Brok.Serv.,Metro. Arpt., Van Nuys, Calif.	B4000	Wright 175	2613 hr.	86 hr.	$1450
W.Arnet Speer,3330Barnett,San Diego,Calif.	B-4000	Wright J5-225	1348 hr.	104 hr.	1250
Sky Harbor Inc., R. R. No. 11, Box 55, Indian, Ind.	Speedwing	Wright J65	800 hr.	July, '40	1200
McInnis Avia. Serv., Minn. Mun. Arpt., Minneapolis, Minn.	B4000	Wright 220	1590 hr.	110 hr.	1175
Hass-Hill. Fly. Serv., Mun. Arpt., Evans., Ind.	E-4000	Wright 175	1000 hr.	100 hr.	1105
N. Idaho Fly. Serv., Weeks Fld., Coeur D'Alene, Idaho	4000	Wright J5-220	1100 hr.	1050 hr.	1100
J. L. Schroeder, Inc., Rt. 3, Box 117, Houston, Tex.	4000 J5 Duster	220 h.p.	650 hr.	10 hr. since overhaul	950
Art Whitaker, Portland Arpt., Portland, Ore.		Wright J-5	800 hr.	780 hr.	875
Sky Harbor,Inc.,R.R.No.11,Box 551,Indian,Ind.		Tank 115	78 hr.	ship7-40	800
Aero Serv., McKinley Arpt., Canton, Ohio.	Trainer	Wright Gipsy 96	700 hr.	5 hr.	800
Calif. Aircft. Corp., P. O. Box 170, Van Nuys, Calif.		Hisso E180	150 hr.		775
Al Leeward, New Kensington, Pa.		Challenger 185	700 hr.	16 hr.	765
St.Louis Fly.Serv.,Lambert Fld.,Robertson,Mo.		Wright Gipsey 90 h. p.	480 hr.	just	745
St.Louis Fly. Serv.,Lambert Fld.,Robertson,Mo.		Wright 90	480 hr.	just ove.	745
Calkins Aircr. Co., 1022 N. Atlantic, Spokane, Wash.		Warner 125	1447 hr.	plane & Eng. 30 hr. ago	700
Leeward Aircft. Sale, New Kensington, Pa.		Chall. 185	700 hr.	16 hr.	695
V. S. King, Warren Arpt., Warren, Pa.	2000	Tank 73-115	725 hr.	40 hr.	525
VERVILLE					
Al Gillis Fly. Serv., Great Falls, Mont.		Wright 250	1200 hr.	10 hr.	1400
J. C. Bashioum, 107 N. Gladstone Blvd., Kansas City, Mo.	Air coach	Wright J6-7	1100 hr.	60 hr.	700
WACO					
McInnis Avia.Serv.,Minn.Mun.Arpt.,Minn.,Minn.	UPF7	Cont. 220	105 hr.	new	7175
McInnis Avia.Serv.,Minn.Mun.Arpt.,Minn.,Minn.	UPF7	Cont. 220	360 hr.	new	6950
Parkersburg Fly. Serv., Arpt., Parkersburg, W. Va.	N	Jacobs 330	100 hr.		6000
Lane Avi. Corp., Cleve. Arpt., Cleve., Ohio.	ZGC	Jacobs 285	800 hr.	150 hr.	5500
A. E. Padage, Wisconsin Rapids, Wisc.	Custom	Jacobs 285	360 hr.	40 hr.	4500
Falcon Aircraft, Inglewood, Cal.	F-7	Jacobs 285	140 hr.		4250
Hawthorne Flying Serv., Mun. Arpt., Charleston, S. C.	ZPF7	Jacobs 285	600 hr.	250 hr.	3500
Muncie Avia. Corp., Muncie Airp.,Muncie,Ind	Custom '36	Wright 285	1150 hr.	no time	3500
Hawthorne Fly. Serv., Mun. Airp., Charleston, S. C.	'37 2 pole ZPF6	Jacobs L5 MB 285 h.p.	760 hr.	320 hr.	3500
Air Serv., Inc., Mun. Arpt., Denver, Colo.	1935 Cus.	Jacobs 225	950 hr.	no time	3200
Daitz Fly. Corp., Roosevelt Fld., Mineola,N.Y.	CUC	Wright 250	315 hr.	15 hr.	2850
R. Turner Aero Corp., Indianapolis, Ind.		Jacobs 225			2750
Hylan Fly. Serv., Inc., Arpt., Rochester, N. Y.	YOC	Jacobs 225	422 hr.	Apr. '39	2600
E. W. Wiggins Airways, Inc., Providence, R. I.	C	Wright 285	350 hr.	recently	2500
Krantz Aeronautical Serv., Pt. Erie, Erie, Pa.	C6	Wright 320	650 hr.	200 hr.	2500
Inter City Airlines, Mun. Arpt., E. Boston, Mass.	Cabin	Jacobs 225	845 hr.	215 hr.	2475
Bowman Fly. Serv., Arpt., Keene, N. H.	NKC-S	Cont. 210	550 hr.	145 hr.	2300
Aviation Serv. Co., P.O. Box 32, Brainard Field, Hartford, Conn.	YOC	Jacobs 225	700 hr.	200 hr.	2250
Wallace Aircraft Co., Clarcona, Fla.	S	Jacobs 225	450 hr.		2250
Avia. Serv. Co., Brainard Fld, Hartford, Conn.	YOC	Jacobs 225	710 hr.	210 hr.	2250
Inter City Airlines, Boston Mun. Airp., East Boston, Mass.	Cabin	Jacobs 225	845 hr.	213 hr.	2175
N. R. McCray, Arpt., Jamestown, N. Y.	CSTD	Jacobs 225	410 hr.	250 hr.	2100
Sioux Skyw. Mun. Arpt., Si. Falls, S. D.	36 Custom	Jacobs 225L4	625 hr.	50 hr.	2100
E. W. Wiggins Airways., Inc., Providence, R. I.	F3	Jacobs 225	600 hr.	recently	2000
J. Ruzuika, Circus City Arpt., Peru, Ind.	Cabin	Jacobs 225	700 hr.	110 hr.	2000
J. L. Wells, 106 W. Main, Avon Park, Fla.	YKC	Jacobs 225	650 hr.	200 hr.	2000
R. K. Benson, 232 Keller Ave., Kenmore, N. Y.	YKC	Jacobs 225	800 hr.	6/15/40	1950
H. G. Phillips, Arpt., Mt. Pl., Mich.		Cont. 210	500 hr.	200 hr.	1700
Phillips Fly. Serv., Arpt., Mt. Pleasant Mich.	Cabin	Cont. 210	475 hr.	340 hr.	1700
L. H. Melter, Solon Arpt., Solon, Ohio.	YKC	Jacobs 225	650 hr.	450 hr.	1700
R. K. Bensen, 232 Keller Ave., Kenmore, N. Y.	Cabin & SC	Cont. 210	875 hr.	10/40	1575
Bill LePine Tri-Cities Airp., Endicott, N. Y.	UEC	Cont. 210	500 hr.	500 hr.	1500
Falcon Aircraft, Inglewood, Cal.	Cabin	Cont. 210	800 hr.	150 hr.	1495
R. E. Lee, Mun. Arpt., Rocky Mount, N. C.	UEC	Cont. 210	870 hr.	9/40	1380
Red Bank Arpt., Inc., Red Bank, N. J.	Cabin YKC	Jacobs 225	950 hr.	95 hr.	1350
Arents Air Serv., Armonk, N. Y.	OEC	Kinner 210	775 hr.	40 hr.	1275
Rocky Mt. Fly. Serv., Mun. Serv., Roc. Mt., N.C.	UEC	Cont. 670-210	860 hr.	1937 hr.	1250
W. P. Snyder, 417 W. Mulberry,Kokomo,Ind.	Taperwing	J5-9-220	650 hr.	200 hr.	1225
Arent Air Serv., Armonk Village, N. Y.	YBC	Kinner 210	825 hr.	750 hr.	1100
W. P. Synder, Mulberry St., Kokomo, Ind.	Taperwing	Wright		yes	1100
St. Louis Fly. Serv., Lambert Fld., Rob., Mo.	F	War-scarab	1158 hr.	recently	1100
J. F. Barham, Airprt., Santa Rosa, Cal.	RNF	Warner 125	1800 hr.	200 hr.	1095
Southern Air Serv., Memphis, Tenn.		Warner 125	1000 hr.	recently	1050
Aviation Serv. Co., Inc., Brainard Fld., Hartford, Conn.	QDC	Cont. 165	480 hr.	180 hr.	1000
Avia. Serv. Co., Brainard Fld, Hartford, Conn.	QDC	Cont. 165	1042 hr.	182 hr.	1000
Seider Fly. Serv., S.A.M. Arpt., Youngs., Ohio.	St.-Wing	Wright 220	800 hr.	80 hr.	995
Ranger Flyg. Serv., Ranger, Texas.	RNF	Warner 125	1050 hr.	(1939)	975
N.Air Serv.,Gr.Ra.Arpt.,Grand Rapids,Mich.	KNF	Kinner 100	962 hr.	yes	950
Aero Serv., Inc., McKinley Arpt., Canton, Ohio.	Str.-Wing	Wright J-5	800 hr.	50 hr.	950
J. Jones, Mun. Arpt., Lancaster, Pa.	F	Kinner 125	1200 hr.	50 hr.	900
Racine Fly. Serv., Arpt., Racine, Wisc.	Taperwing	Wright 250	385 hr.	370 hr.	850
WELCH					
Hawthorne Fly. Serv., Mun. Airpr., Charleston, S. C.	OW5M	Cont. 40	103 hr.		500



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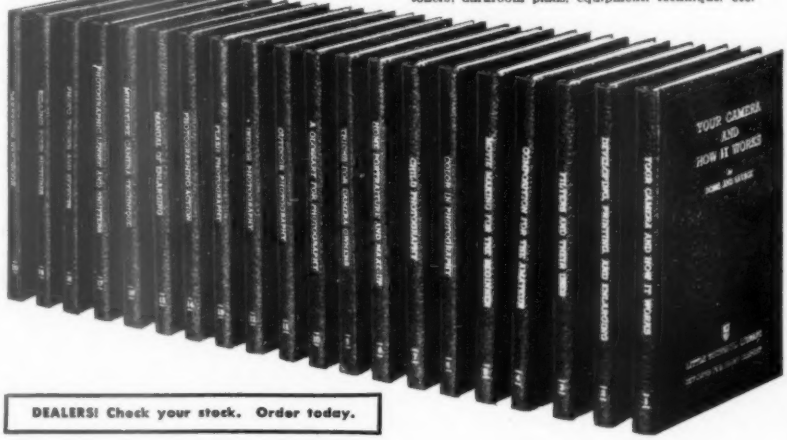

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